



## The deep-water Indo-Pacific radiation of *Fusinus* (*Chryseofusus* subgen. nov.) (Gastropoda: Fascioliariidae)

### La radiación Indo-Pacífica de aguas profundas del género *Fusinus* (*Chryseofusus* subgen. nov.) (Gastropoda: Fascioliariidae)

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#### ABSTRACT

A number of fusinids from the Indo-Pacific deep-water fauna are studied to get more insight in the distribution and variability. The subgenus *Chryseofusus* (Gastropoda: Fascioliariidae: *Fusinus* Rafinesque, 1815) is described as new to accommodate a number of species sharing conchological characteristics different from typical *Fusinus*. Their separation from *Fusinus* s.s. is based on differences in axial sculpture (usually absent on body whorl), spiral sculpture (weak, close-set, regular, crossed by distinct growth lines), shape (shorter spire, shorter siphonal canal, less convex whorls with subsutural concavity, less constricted suture) and parietal callus (inner lip smooth, parietal wall covered with an extended, adherent thin layer of callus).

*Fusinus* (*Chryseofusus*) *bradneri* (Drivas and Jay, 1990), *F. (C.) chryseudomoides* (Schepman, 1911), *F. (C.) graciliformis* (Sowerby, 1880), *F. (C.) hyphalus* M. Smith, 1940, *F. (C.) jurgeni* Hadorn and Fraussen, 2002, *F. (C.) kazdailisi* Fraussen and Hadorn, 2000 and *F. (C.) subangulatus* (von Martens, 1901) are briefly described and their taxonomic placement in the new subgenus is discussed.

To avoid further taxonomic complications, a lectotype is designated for the correct *F. (C.) chryseudomoides*.

*F. (C.) acherusius* (west Madagascar, Mozambique Channel, 1475-1530 m), *F. (C.) alisae* (north New Caledonia, 444-452 m), *F. (C.) artutus* (Philippines, Bohol, deep water), *F. (C.) cadus* (south New Caledonia, 460-470 m), *F. (C.) dapsilis* (Vietnam, deep water), *F. (C.) riscus* (New Caledonia, Norfolk Ridge, 394-401 m), *F. (C.) scissus* (south New Caledonia, 535 m), *F. (C.) wareni* (New Caledonia, 480 m), and *F. (C.) westralis* (northwest Australia, off Port Hedland, 450 m) are described as new to science.

#### RESUMEN

Se estudia un grupo de fusínidos de la fauna de aguas profundas del Indo-Pacífico, con el fin de profundizar en su distribución y variabilidad. Se describe el subgénero *Chryseofusus* (Gastropoda: Fascioliariidae: *Fusinus* Rafinesque, 1815) para incluir a un número de especies que comparten caracteres conquiológicos distintos de los típicos *Fusinus*. Su separación de *Fusinus* s.s. se basa en diferencias en la escultura axial (normalmente ausente en la espira del cuerpo), escultura espiral (débil, compacta, regular, atravesada por claras líneas de crecimiento), forma (espira más corta, canal sifonal más corto, vueltas menos convexas con concavidad subsutural, sutura menos constreñida) y callo parietal (labio interno liso, pared parietal cubierta con una fina capa de callo adherente).

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*Fusinus* (*Chryseofusus*) *bradneri* (Divas y Jay, 1990), *F. (C.) chrysodomoides* (Schepman, 1911), *F. (C.) graciliformis* (Sowerby, 1880), *F. (C.) hyphalus* M. Smith, 1940, *F. (C.) jurgeni* Hadorn y Fraussen, 2002, *F. (C.) kazdailisi* Fraussen y Hadorn, 2000 y *F. (C.) subangulatus* (von Martens, 1901) se describen brevemente, y se discute su adscripción al nuevo subgénero.

Para evitar futuras complicaciones taxonómicas, se designa un lectotipo para la forma correcta de *F. (C.) chrysodomoides*.

*F. (C.) acherusius* (Madagascar oeste, Mozambique Channel, 1475-1530 m), *F. (C.) alisae* (N de Nueva Caledonia, 444-452 m), *F. (C.) artutus* (Filipinas, Bohol, aguas profundas), *F. (C.) cadus* (S de Nueva Caledonia, 460-470 m), *F. (C.) dapsilis* (Vietnam, aguas profundas), *F. (C.) riscus* (Nueva Caledonia, Norfolk Ridge, 394-401 m), *F. (C.) scissus* (S de Nueva Caledonia, 535 m), *F. (C.) wareni* (Nueva Caledonia, 480 m), y *F. (C.) westralis* (NO de Australia, frente a Port Hedland, 450 m) se describen como especies nuevas.

KEY WORDS: Mollusca, Gastropoda, Fasciolariidae, *Fusinus*, *Chryseofusus*, MUSORSTOM, Indo-Pacific, new subgenus, new species.

PALABRAS CLAVE: Mollusca, Gastropoda, Fasciolariidae, *Fusinus*, *Chryseofusus*, MUSORSTOM, Indo-Pacífico, nuevo subgénero, nuevas especies.

## INTRODUCTION

During French expeditions, called CAMPAGNES MUSORSTOM, conducted by ORSTOM (New Caledonia) and MNHN (Paris) in the Indo-West Pacific and in particular in the seas around New Caledonia, a huge number of interesting species, many of them new to science, are collected. The Fasciolariidae are well represented in this rich material.

The purpose of the present paper is to report on this material, starting with the study of a number of peculiar fusinids from the upper bathyal zone of the Indo-Pacific, which we assign to the new subgenus *Chryseofusus*. Thanks to the large quantity of available material, a profound study was possible, comparing material from all over the Indo-West Pacific. A number of species formerly considered to be endemic, or restricted to a certain area, are now found to have a much more extensive range, a situation also observed by both authors in some lower bathyal Buccinidae. We must conclude the bathyal fauna of some areas is still poorly known and information about distribution is tentative for many bathyal Neogastropoda. In the present paper an effort is made to produce correct information on the distribution of *Chryseofusus* species. As a result *F. val-*

*diviae* Hadorn and Fraussen, 1999 (type locality Somalia) is synonymized with *F. graciliformis* (Sowerby, 1880) (type locality Japan). The west Australian species commonly assigned to "*Siphonofusus chrysodomoides*" is found to be different from the Indonesian type material of *Fusinus chrysodomoides* Schepman, 1911, and herein described as new.

## MATERIAL AND METHODS

The present study is essentially based on the material collected by French research vessels and expeditions in the tropical Indo-West Pacific during the last 30 years:

(a) Material from several expeditions and surveys in the South-West Indian Ocean: BENTHEDI (1977) on board R.V. *Suroit* in the northern part of the Mozambique Channel; MD32 (1982) on board R.V. *Marion-Dufresne* around Réunion Is.; shrimp surveys conducted in the Mozambique Channel by A. Crosnier in 1972-74 on board R.V. *Vauban*, and by R. von Cosel in 1986 on board commercial trawler *Mascareignes III*; as well as material recently obtained as a by-product of commercial shrimp fisheries.

(b) Material from numerous expeditions in the New Caledonia region since 1984 (BIOCAL, MUSORSTOM 4-6, CHALCAL 2, CALSUB, SMIB 1-8, BATHUS 1-4, BERYX 11); we refer to RICHER DE FORGES (1990, 1993b), RICHER DE FORGES AND CHEVILLON (1996) and ROUX (1994) for a narrative of these cruises and station lists.

(c) Material collected since 1981 in other mainly West Pacific regions: Indonesia (CORINDON 2; KARUBAR, see CROSNIER, RICHER DE FORGES AND BOUCHET, 1997); Vanuatu (MUSORSTOM 8, see RICHER DE FORGES, FALIEUX AND MENOU, 1996); Wallis and Futuna (MUSORSTOM 7, see RICHER DE FORGES, 1993a); Fiji (MUSORSTOM 10, BORDAU 1, see RICHER DE FORGES, NEWELL, SCLACHER-HOENLINGER, SCHLACHTER, NATING, CÉSA AND BOUCHET, 2000; RICHER DE FORGES, BOUCHET, DAYRAT, WARÉN AND PHILIPPE, 2000) and Tonga (BORDAU 2).

Material from these expeditions is, unless otherwise stated, deposited in MNHN. No individual catalogue number is allocated, but material is unambiguously designated (and retrievable) by the combination of expedition acronym and station number.

The method of VERDUIN (1977) was employed to count the number of protoconch whorls.

Abbreviations used in this paper:

AMS Australian Museum, Sydney, Australia  
 BMNH The Natural History Museum, London, Great Britain  
 IMT Institute of Malacology, Tokyo, Japan  
 IRD Institut de recherche pour le développement, Nouméa, New Caledonia

KMMA Klaipeda Maritime Museum and Aquarium, Klaipeda, Lithuania  
 MNHN Muséum national d'Histoire naturelle, Paris, France  
 NM Natal Museum, Pietermaritzburg, South Africa  
 NMBE Naturhistorisches Museum Bern, Switzerland  
 NMNZ Museum of New Zealand *Tē Papa Tongarewa*, Wellington, New Zealand  
 NSMT National Science Museum, Tokyo, Japan  
 RMNH National Museum of Natural History – Naturalis, Leiden, The Netherlands  
 SMNH Swedish Museum of Natural History, Stockholm, Sweden  
 USNM National Museum of Natural History, Smithsonian Institution, Washington D.C., USA  
 WAM Western Australian Museum, Perth, Australia  
 ZMA Zoologisch Museum, University of Amsterdam, Amsterdam, the Netherlands  
 ZMB Museum für Naturkunde (Zool. Museum), Berlin, Germany  
 KF Collection Koen Fraussen, Aarschot, Belgium  
 RH Collection Roland Hadorn, Röthenbach, Switzerland  
 CA (casier) trap  
 CC (chalut à crevettes) shrimp trawl  
 CH (chalut) trawl  
 CP (chalut à perche) beam trawl  
 DC (drague Charcot) Charcot dredge  
 DE (drague épibenthique) epibenthic dredge  
 DR (drague à roche) rock dredge  
 DW (drague Warén) Warén dredge  
 dd dead collected specimen  
 juv juvenile specimen  
 lv live collected specimen  
 subad subadult specimen

SYSTEMATICS

Family FASCIOLARIIDAE Gray, 1853  
 Genus *Fusinus* Rafinesque, 1815

*Fusinus* Rafinesque, 1815. *Anal. nat. tabl. univ. corps org.*: 145. Substitute name for '*Fusus* Lamarck' [= *Fusus* Bruguière, 1789], non *Fusus* Helbling, 1779.

Type species: *Murex colus* Linnaeus, 1758, by typification of replaced name.

**Description:** Shells fusiform, small to large in size, elongate, with tall spire and long siphonal canal. Usually well-ribbed and with spiral threads. Columellar folds absent. Operculum corneous, shape and size corresponding to aperture, nucleus terminal.

**Radula:** with small tricuspid central tooth, lateral teeth curved, with 4 to about 15 strong, long pointed cusps.

**Remarks:** *Colus* Humphrey, 1797 is invalid (Humphrey has been ruled as non-binominal by ICZN).

### *Chryseofusus* subgen. nov.

Type species: *Fusus chryseofusus* Schepman, 1911 (Figs. 8-9).

**Etymology:** Derived from the Latin "chryseus" (adjective: made of gold), meaning "a *Fusus* made of gold", after the yellowish coloured periostracum of some of the species. Hereby also evocating the name of the type species: *Fusus chryseofusus* Schepman, 1911.

**Diagnosis:** Shell small to medium, usually thin, light in weight, shape fusiform. Whorls slightly convex, shoulder slope on latter whorls concave, sometimes slightly keeled, suture indistinct. Rather strong axial ribs on upper whorls, axial sculpture on latter whorls usually weak or absent. Spiral sculpture indistinct, close-set, regular, consisting of weak primary cords and intercalated fine threads, crossed by strong, close-set, curved axial growth lines, giving the surface the texture of linen. Protoconch typical of genus, ~1 to ~1 1/4 whorls, smooth, glossy, last part (~1/4 whorl) often sculptured with some axial riblets. Aperture ovate, white, yellowish or brownish; outer lip simple, with or without internal lirae; inner lip completely smooth, parietal wall covered with an extended, adherent thin layer of callus, never forming a detached inner lip like in *F. colus*. Columellar folds absent. Siphonal canal as long as aperture or slightly shorter, slightly curved or straight, open. Shell uniformly whitish, dirty greyish or brownish. Some species with pale reddish coloured spiral sculpture. Operculum typical of genus, corneous, shape and size corresponding to aperture, nucleus terminal. Periostracum usually yellowish or brownish, often well adherent, thick and velvety. Radula typical of genus, central tooth tricuspid, lateral teeth curved, with 4-8 strong pointed cusps.

**Range and habitat:** *Chryseofusus* is ecologically a deep water group, accommodating species from the Indo-Pacific upper bathyal zone, between 100 and 1900 m deep. Until present date we have not recognized any Atlantic species as belonging to *Chryseofusus*.

**Species in *Chryseofusus* (in alphabetical order):** *F. acherusius* sp. nov., Mozambique Channel and New Caledonia in 1530-1900 m; *F. alisae* sp. nov., New Caledonia and Coral Sea in 300-545 m; *F. artutus* sp. nov., Philippines, Indonesia and New Caledonia in 271-435 m; *F. bradneri* (Drivas and Jay, 1990), Reunion, north Madagascar, Glorieuses and Comoro Islands in 300-750 m; *F. cadus* sp. nov., New Caledonia in 460-675 m; *F. chryseofusus* (Schepman, 1911), Indonesia, southwest Pacific and north Madagascar in 179-797 m; *F. dapsilis* sp. nov., Vietnam, deep water; *F. graciliformis* (Sowerby, 1880), east Asia and east Africa in 50-600 m; *F. hypophalus* M. Smith, 1940, Japan, Philippines and east China Sea in 100-300 m; *F. jurgeni* Hadorn and Fraussen, 2002, southwest Madagascar in 530 m; *F. kazdailisi* Fraussen and Hadorn, 2000, Chile in 150-1200 m; *F. riscus* sp. nov., south New Caledonia in 401-430 m; *F. scissus* sp. nov., south New Caledonia in 410-580 m; *F. subangulatus* (von Martens, 1901), east Africa in 400-1134 m; *F. wareni* sp. nov., New Caledonia in 480-755 m; *F. westralis* sp. nov., Western Australia in 300-500 m.



**Comparison:** *Chryseofusus* differs from all other subgenera in *Fusinus* by the slightly convex, usually unkeeled whorls with subsutural concavity, the presence of axial ribs usually only on upper whorls, the weak, close-set, regular spiral sculpture crossed by strong, close-set, curved axial growth lines, giving the surface the texture of linen or a sometimes pearly appearance. Outer lip always simple; inner lip completely smooth, the never detached parietal callus consists of an extended, adherent thin layer of callus.

*F. bradneri* and *F. chrysodomoides*, now placed in *Chryseofusus* on the base of conchological characteristics and the fusinid radula, have generally been referred to the buccinid genus *Siphonofusus* Kuroda and Habe, 1952.

*F. graciliformis* and *F. hyphalus* have been referred to the conchologically similar genus *Simplicifusus* Kuroda and Habe in Kuroda, Habe and Oyama, 1971, but can be distinguished by operculum morphology.

*Simplicifusus noguchii* (Fig. 1) was named by Habe and Masuda for all the Japanese material previously referred to as *S. simplex* (E.A. Smith, 1879). Kuroda *et al.* referred to that material when they designated '*Fusinus simplex* (Smith)' as the

type species of *Simplicifusus*. BIELER AND PETIT (1996: 33), HIGO, CALLOMON AND GOTO (1999: 263) and SNYDER (2000: 175) already reported on this problem. This matter will be dealt in a future paper by Snyder (pers. comm. M. A. Snyder).

For comparison we figure the holotype of *Fusinus simplex* E.A. Smith, 1879 [BMNH 1878.11.7.27, a juvenile specimen of 18.0 x 5.5 mm, type locality: south of Korea] (Figs. 5, 6). It belongs to *Fusinus* s.s. and has a typical fusinid operculum with terminal nucleus (Fig. 7).

For comparison we also figure *S. noguchii* Habe and Masuda, 1990 (Fig. 1), and its operculum (Fig. 2) which is completely different from all other treated species belonging to the new subgenus *Chryseofusus* and all other subgenera in *Fusinus* Rafinesque, 1815, which all have a typically fusinid operculum with terminal nucleus (Fig. 3). The operculum of *S. noguchii* (Fig. 2) is small, ovate, thin, much smaller than the aperture, and the nucleus is situated at lower outer side. It is identical to the operculae of the genus *Granulifusus* Kuroda and Habe, 1954 [Type species: *Fusinus niponicus* E.A. Smith, 1879] (Fig. 4). Future study may show that *Simplicifusus* may be a junior synonym of *Granulifusus*.

### *Fusinus* (*Chryseofusus*) *chrysodomoides* (Schepman, 1911) (Figs. 8-13, 76, 86)

*Fusinus chrysodomoides* Schepman, 1911. *Rés. Siboga Exp.*, Mon 49 (1), part 4: 293, pl. 19, fig. 4; pl. 23, fig. 10.

#### SUBSEQUENT USE

*Siphonofusus chrysodomoides* (Schepman, 1911). non KOSUGE (1985: 59, pl. 23, fig. 7), WILSON (1994: 66, pl. 12, figs. 7a-b), HADORN AND FRAUSSEN (1999: pl. 3, figs. 17-18).

*Fusinus chrysodomoides* (Schepman, 1911). HADORN AND FRAUSSEN (1999: 117, 120).

**Type material:** Lectotype ZMA, SIBOGA (70.7 x 24.9 mm, lv, preserved with animal in alcohol), designated herein (Figs. 8-9). – 1 paralectotype ZMA 3.11.021, Indonesia, near Kai Islands, SIBOGA stn 262, 5° 53' 8" S, 132° 48' 8" E, 560 m (66.9 x 25.6 mm, lv).

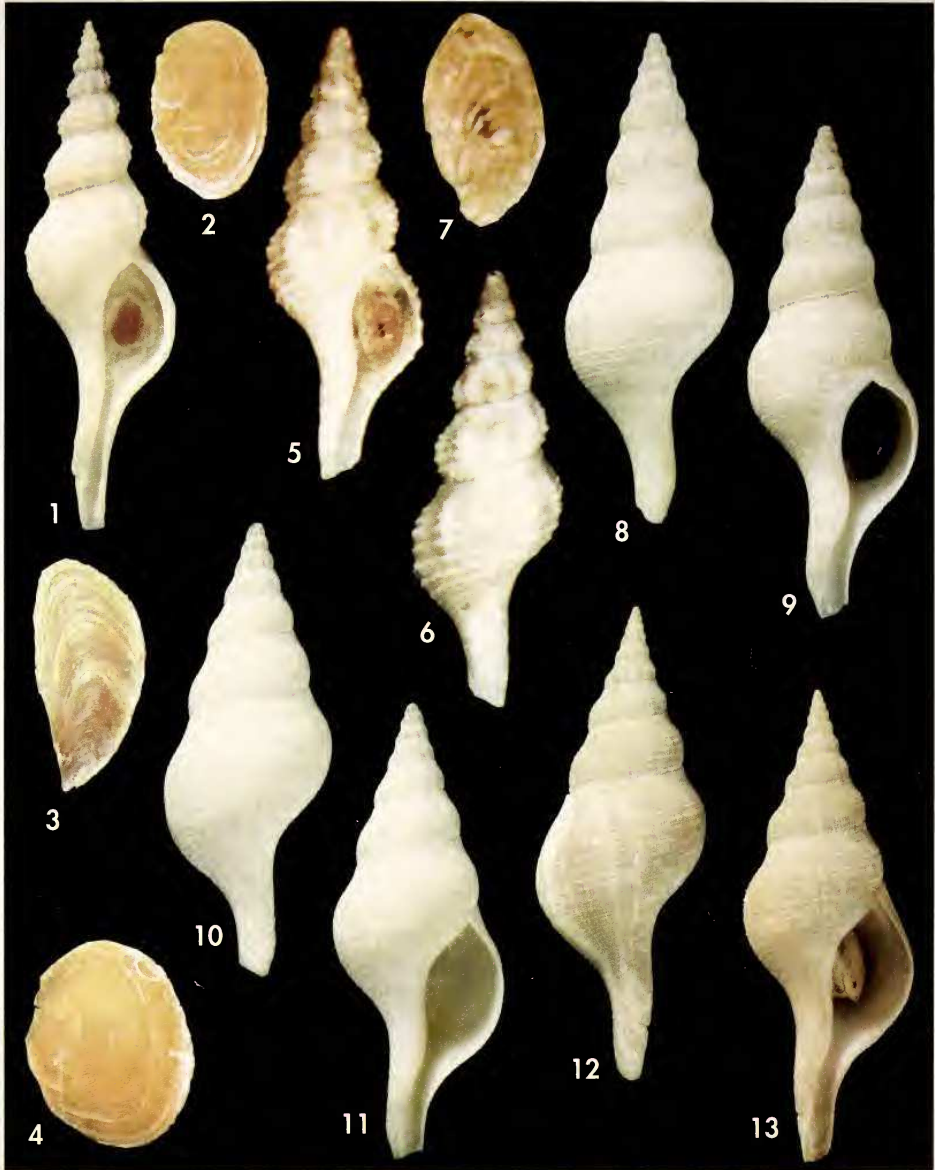
Because of the previous confusion with regard to this species and to ensure a taxonomic correct interpretation in the future, the selection of a lectotype for this species is advisable. We hereby select the specimen figured by Schepman as lectotype.

**Type locality:** Indonesia, Molucca-Passage, SIBOGA stn 139, 0° 11' S, 127° 25' E, 397 m.

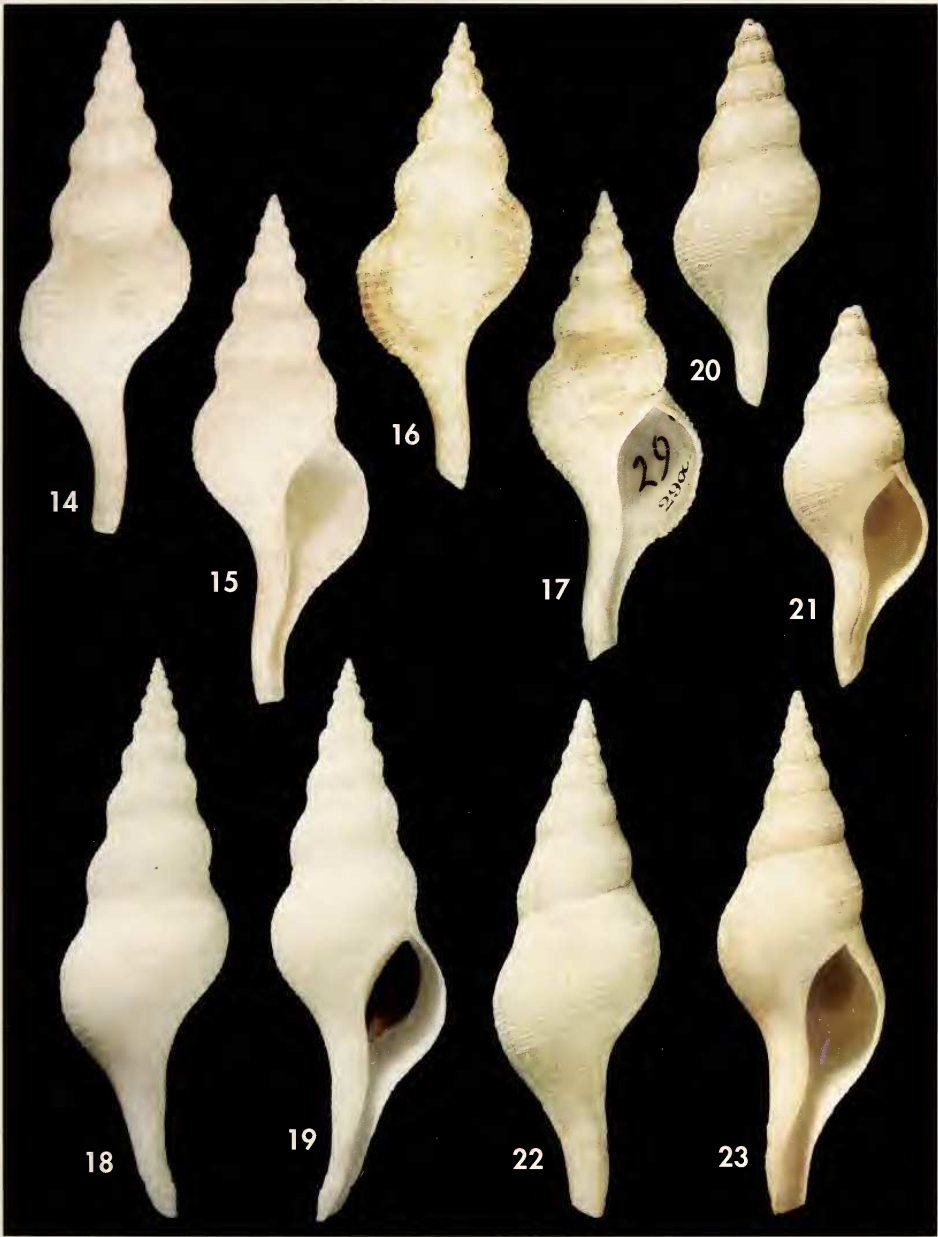
**Material examined:** Lectotype and paralectotype of *Fusinus chrysodomoides* in ZMA.

North Madagascar, 12° 50' S, 48° 09' E, 580-585 m, 1 dd/1 dd juv; 12° 43' S, 48° 15' E, 300-340 m, 1 dd. – North Madagascar, 350-400 m, 1 dd juv/1 dd, collected by commercial boats, RH.

Indonesia, north Makassar Strait, CORINDON II stn CH276, 01° 55' S, 119° 13' E, 395-450 m, 1 dd. – Tanimbar Islands, KARUBAR stn DW44, 07° 52' S, 132° 48' E, 291-295 m, 1 dd juv. – Kai



Figures 1, 2. *Simplicifusus noguchii* Habe and Masuda, 1990. 1: RH, Japan, Mikawa, Aichi Pref., 54.8 mm; 2: Opérculo. Figure 3. Opérculo of *Fusinus colus* (Linnaeus, 1758). Figure 4: Opérculo of *Granulifusus niponicus* (E.A. Smith, 1879). Figures 5-7. *Fusinus simplex* (E.A. Smith, 1879), Holotipo BMNH 1878.11.7.27, south of Korea, 18,0 mm. 7: Opérculo. Figures 8-13. *Fusinus (Chryseofusus) chryseodomoides* (Schepman, 1911). 8, 9: Lectotipo ZMA, Indonesia, Molucca-Passage, 70,7 mm; 10, 11: Paralectotipo ZMA 3.11.021, Indonesia, near Kai Islands, 66,9 mm; 12, 13: MNHN, Fiji, 70,9 mm. *Figuras 1, 2. Simplicifusus noguchii* Habe y Masuda, 1990. 1: RH, Japón, Mikawa, Aichi Pref., 54,8 mm; 2: Opérculo. *Figura 3. Opérculo de Fusinus colus* (Linnaeus, 1758). *Figura 4. Opérculo de Granulifusus niponicus* (E.A. Smith, 1879). *Figuras 5-7. Fusinus simplex* (E.A. Smith, 1879), Holotipo BMNH 1878.11.7.27, S de Corea, 18,0 mm. 7: Opérculo. *Figuras 8-13. Fusinus (Chryseofusus) chryseodomoides* (Schepman, 1911). 8, 9: Lectotipo ZMA, Indonesia, Molucca-Passage, 70,7 mm; 10, 11: Paralectotipo ZMA 3.11.021, Indonesia, cerca de Kai Islands, 66,9 mm; 12, 13: MNHN, Fiji, 70,9 mm.



Figures 14-21. *Fusinus* (*Chryseofusus*) *graciliformis* (Sowerby, 1880). 14, 15: Holotype BMNH 1880.10.15.2, Japan, 52.5 mm; 16, 17: Holotype of *Fusus sieboldi* Schepman, 1891 (junior synonym), RMNH 86858, Japan, 40.0 mm; 18, 19: KF 3200, Philippines, 81.9 mm; 20, 21: Paratype 1 of *Fusinus valdiviae* Hadorn and Fraussen, 1999 (junior synonym), KF 2811, Somalia, 47.4 mm. Figures 22, 23. *Fusinus* (*Chryseofusus*) *hyphalus* M. Smith, 1940, RH, Taiwan, 50.3 mm.

Figuras 14-21. *Fusinus* (*Chryseofusus*) *graciliformis* (Sowerby, 1880). 14, 15: Holotipo BMNH 1880.10.15.2, Japón, 52,5 mm; 16, 17: Holotipo de *Fusus sieboldi* Schepman, 1891 (sinónimo junior), RMNH 86858, Japón, 40,0 mm; 18, 19: KF 3200, Filipinas, 81,9 mm; 20, 21: Paratipo 1 de *Fusinus valdiviae* Hadorn y Fraussen, 1999 (sinónimo junior), KF 2811, Somalia, 47,4 mm. Figuras 22, 23. *Fusinus* (*Chryseofusus*) *hyphalus* M. Smith, 1940, RH, Taiwan, 50,3 mm.



Islands, KARUBAR stn CP16, 05° 17' S, 132° 50' E, 315-349 m, 1 dd juv; stn CP27, 05° 33' S, 132° 51' E, 304-314 m, 2 dd juv.

Philippines, northwest of Mindanao, Aliguay Island, 150 m, 1 dd, Snyder coll.

Vanuatu, MUSORSTOM 8 stn DW958, 20° 21' S, 169° 47' E, 497-570 m, 1 lv; stn DW1105, 15° 03' S, 167° 07' E, 154-179 m, 1 dd; stn CP1124, 15° 02' S, 166° 57' E, 532-599 m, 1 dd.

North New Caledonia, BATHUS 4 stn CP948, 20° 33' S, 164° 57' E, 533-610 m, 1 dd; stn CP950, 20° 32' S, 164° 56' E, 705-750 m, 1 dd.

South New Caledonia, SMIB 1 stn DW2, 22° 52' S, 167° 13' E, 415 m, 1 dd.

New Caledonia, Loyalty Ridge, CALSUB pl. 11, 20° 52' 5" S, 167° 03' E, 577 m, 1 dd; MUSORSTOM 6 stn DW483, 21° 20' S, 167° 48' E, 600 m, 1 dd juv.

Southwest Pacific, Tuscarora Bank, MUSORSTOM 7 stn DW555, 11° 47' S, 178° 19' W, 540-542 m, 1 dd.

Fiji, Bligh Water, MUSORSTOM 10 stn DW1314, 17° 16.1' S, 178° 14.8' E, 656-660 m, 1 lv juv; stn CP1327, 17° 13.3' S, 177° 51.6' E, 370-389 m, 1 fragment; stn CP1330, 17° 09.5' S, 177° 56.3' E, 567-699 m, 2 lv/2 lv juv; stn CP1341, 16° 52.5' S, 177° 43.7' E, 500-614 m, 1 lv/1 dd.

Fiji, BORDAU 1 stn CP1401, 16° 35' S, 179° 41' W, 600-648 m, 4 lv juv/2 dd juv; stn CP1407, 16° 40' S, 179° 39' E, 499-527 m, 1 lv juv; stn CP1448, 16° 45' S, 179° 59' E, 410-500 m, 1 lv juv; stn DW1451, 16° 45' S, 179° 59.5' E, 400-460 m, 2 lv juv; stn CP1502, 18° 21' S, 178° 27' W, 640-660 m, 1 dd.

Tonga Islands, BORDAU 2 stn DW1538, 21° 39' S, 175° 19' W, 471-508 m, 1 dd juv; south Nomuka group, stn DW1554, 20° 38' S, 174° 58' W, 482-498 m, 1 dd juv; Chenal north Nomuka, stn DW1555, 20° 11' S, 174° 45' W, 591 m, 1 dd juv; "Seamount", stn DW1605, 22° 17' S, 175° 16' W, 441 m, 2 fragments; stn CP1620, 24° 18' S, 176° 20' W, 572 m, 1 dd; northwest Tongatapu, stn CP1640, 21° 09' S, 175° 24' W, 564-569 m, 1 lv juv; stn CP1642, 21° 05' S, 175° 23' W, 532 m, 1 dd juv.

*Description:* Shell medium-sized (60.0–85.0 mm), uniformly off-white to brownish, fusiform, with rather long conical spire, solid, about 10 convex unkeeled whorls, slightly concave below suture, appressed to the preceding whorl. Suture not deep, wavy on upper whorls following the axial sculpture, and straight on latter whorls.

Upper teleoconch whorls with relatively strong axial ribs, separated by interspaces of same width. 10-14 axial ribs on uppermost whorl, 9-11 on the following 3-5 whorls, disappearing on latter whorls.

Spiral sculpture fine. 4 or 5 primary spiral cords on uppermost teleoconch whorls; 1 fine intercalated thread on fourth whorl becoming as strong as the primary ones on following whorls. Fine tertiary threads appear from sixth or seventh whorl on; the number increases to 3 or 4 of unequal strength on body whorl. Spiral sculpture crossed by curved, strong, well-visible and close-set growth lines, giving surface the texture of linen.

Aperture ovate, pinched at both ends, white. Parietal callus thin, smooth and glossy, extended and adherent to parietal wall. Columellar folds absent. Outer lip thin, simple, smooth inside.

Siphonal canal relatively short, about as long as aperture, curved. Outer side sculptured with fine spirals, crossed by growth lines.

Operculum typical of genus, corneous, brown, shape and size corresponding to aperture, nucleus terminal.

Periostracum brown.

Radula (Figs. 76, 86) typically fusinid. Central tooth with tricuspid base, the median cusp longest, base broader than the notched anterior margin. Lateral teeth broad, strongly curved, with 6-9 cusps of subequal length, at both ends with a small denticle.

*Range and habitat:* Indonesia, Philippines, northern Madagascar, and southwestern Pacific (New Caledonia, Vanuatu, Fiji and Tonga) between 179 and 797 m deep.

*Remarks:* *F. chrysodomoides* was placed in the genus *Siphonofusus* (Buccinidae) by authors, but the radula (Figs. 76, 86) and conchological characteristics are typical of the genus *Fusinus*. The Australian shells figured as *Siphonofusus chrysodomoides* by WILSON (1994: 66, pl. 12, figs. 7a-b) or as *Fusinus chrysodomoides* by HADORN AND FRAUSSEN (1999: pl. 3, figs. 17-18) are clearly different from the Indonesian type material. The Australian species is



described as *F. westralis* sp. nov. later on in this paper. *F. westralis* differs from *F. chrysodomoides* by the clearly larger shell size, the more slender and more extended spire, the larger number of whorls, by the more concave shoulder slope especially on the lower whorls, the narrower interspaces between the axial ribs on upper whorls, and finally by the finer spiral sculpture and the larger number of very fine intercalated spiral threads.

*F. chrysodomoides* from New Caledonia usually have more prominent and broader axial ribs on upper whorls. All specimens from Fiji and Tonga and most specimens from New Caledonia are brownish coloured as opposed to the white coloured type material of *F. chrysodomoides* from Indonesia, the white coloured specimens from the East African coast and one specimen from New Caledonia (CALSUB 1989 pl. 11). However, we found no evidence to separate the white and the brownish coloured specimens. Moreover, the radulae of the New Caledonian specimens are nearly identical to the figured radula of the paralectotype of *F. chrysodomoides* (SCHEPMAN, 1911: Fig. 10).

BOUCHET AND WARÉN (1986: 475) noted, that *Manaria insularis* Okutani,

1968 "resembles closely *Fusus chrysodomoides* Schepman, 1911". After examination of the holotype of *Manaria insularis* [NSMT Mo. 60220; Type locality: Japan, off Hachijo Island, R/V Soyomaru stn B3, 33° 08.3' N, 140° 01.8' E, 460 m] and direct comparison with the type material of *F. chrysodomoides* we found out, that both species are clearly distinct. *F. chrysodomoides* clearly has a larger adult size, a smaller spire angle (~35°-38° / *M. insularis*: ~42°), a proportionally longer spire and a narrower siphonal canal. The axial ribs are usually restricted to the spire tip, are more prominent and separated by wider interspaces. The spiral sculpture on upper whorls clearly consists of less distinct spiral cords and is also present in the interspaces between the axial ribs. The growth lines are prominent and well-visible on all whorls, a characteristic of all *Chryseofusus*. *M. insularis* only has inconspicuous growth lines. *F. chrysodomoides* has a smooth columella as opposed to *M. insularis*, which has one weak columellar fold.

No genus nor family (Buccinidae or Fascioliariidae) can be ascertained to accommodate *M. insularis*, until more material with animal and radula, is found.

### *Fusinus* (*Chryseofusus*) *graciliformis* (Sowerby, 1880) (Figs. 14-21, 87)

*Fusus graciliformis* Sowerby, 1880. *Thes. Conch., Monogr. Fusus*, 4: 80, pl. VII, fig. 62.

#### SYNONYMS

*Fusus sieboldi* Schepman, 1891. *Notes Leyden Mus.*, 13 (2): 62; 1891: *Notes Leyden Mus.*, 13 (17): 157, pl. 9, figs. 3a, b.

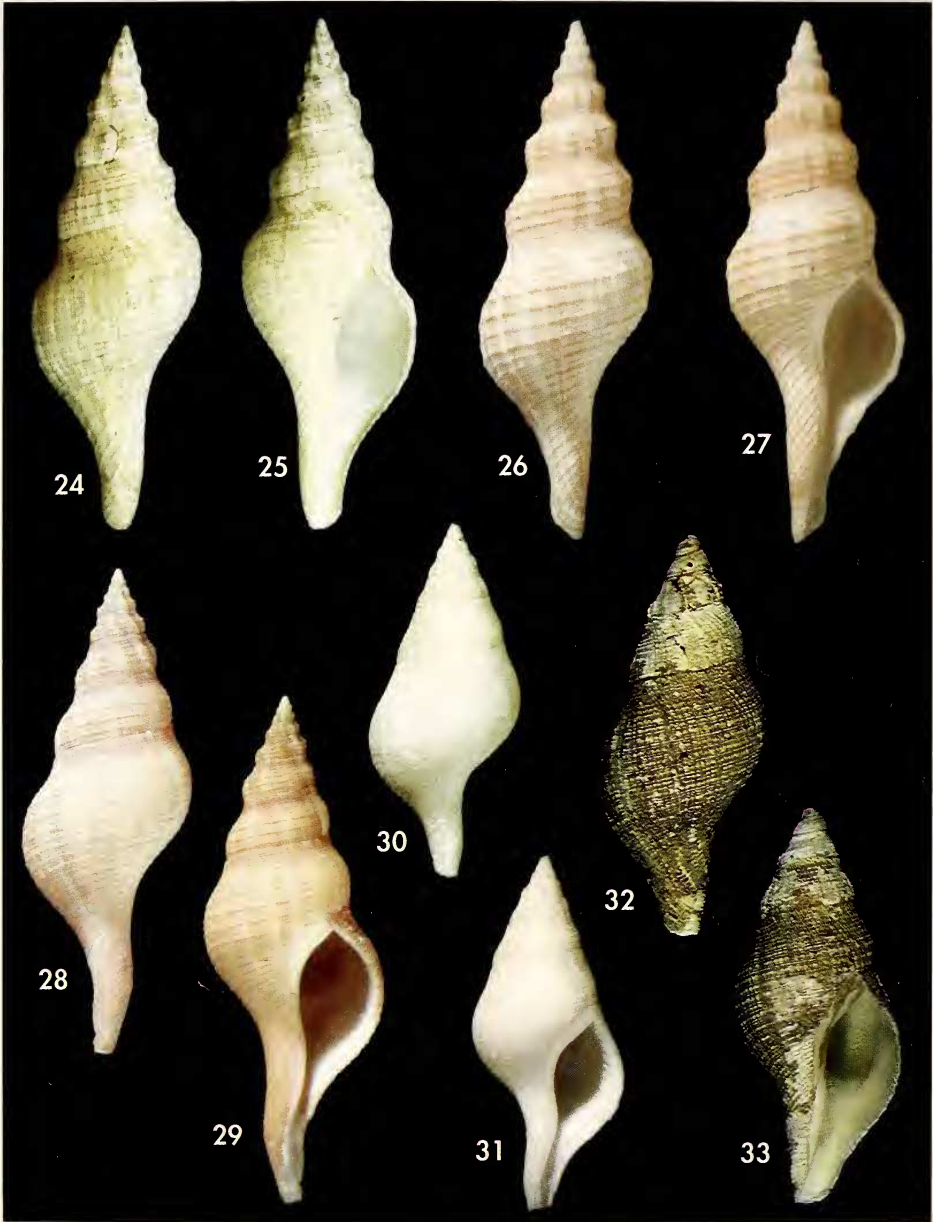
*Fusinus valdiviae* Hadorn and Fraussen, 1999. *Vita Marina*, 46 (3-4): 117-120, figs. 11-16, text fig. 2.

#### SUBSEQUENT USE

*Fusinus graciliformis* (Sowerby, 1880). FUJITA (1929: 90, pl. 3, fig. 11).

*Simplicifusus graciliformis* (Sowerby, 1880). KURODA AND HABE in Kuroda, Habe and Oyama (1971: 282-283, pl. 51, fig. 2).

**Type material:** *F. graciliformis*: Holotype BMNH 1880.10.15.2 (52.5 × 18.0 mm, dd) – *F. sieboldi*: Holotype RMNH 86858 (40.0 × 15.2 mm, dd). – *F. valdiviae*: Holotype MNHN (50.2 × 18.9 mm, lv subad); 11 paratypes, Somalia, deep water, KF, RH and B. Briano (42.5-62.9 mm, dd subad); 1 paratype BMNH 1998187, Somalia, deep water (48.0 × 17.1 mm, dd subad); 1 paratype NMBE 1727.99, Somalia, deep water (45.7 × 17.0 mm, dd subad); 1 paratype IMT-99-2, Somalia, deep water (44.9 × 18.3 mm, dd subad); 3 paratypes, Gulf of Aden, Somalia, deep water, H. Dekker (49.0-60.5 mm, dd subad); 1 paratype ZMB, VALDIVIA stn 256, 01° 49' N, 45° 29' E, 1134 m (47.2 × 18.3 mm, dd subad).



Figures 24-27. *Fusinus (Chryseofusus) subangulatus* (von Martens, 1901). 24, 25: Lectotype ZMB 59931, south Somalia, near Kismaayo, 71.1 mm; 26, 27: RH, Somalia, 55.3 mm. Figures 28-31. *Fusinus (Chryseofusus) bradneri* (Drivas and Jay, 1990). 28, 29: MNHN, Reunion, off Saint-Gilles, 53.5 mm; 30, 31: MNHN, Glorieuses Islands, dwarf form?, 48.4 mm. Figures 32, 33. *Fusinus (Chryseofusus) kazdailisi* Fraussen and Hadorn, 2000, Holotype KMMA LJM925, Chile, Nazca Ridge, 40.0 mm. *Figuras 24-27. Fusinus (Chryseofusus) subangulatus (von Martens, 1901). 24, 25: Lectotipo ZMB 59931, S de Somalia, cerca de Kismaayo, 71,1 mm; 26, 27: RH, Somalia, 55,3 mm. Figuras 28-31. Fusinus (Chryseofusus) bradneri (Drivas y Jay, 1990). 28, 29: MNHN, Reunion, frente a Saint-Gilles, 53,5 mm; 30, 31: MNHN, Glorieuses Islands, ¿forma enana?, 48,4 mm. Figuras 32, 33. Fusinus (Chryseofusus) kazdailisi Fraussen y Hadorn, 2000, Holotipo KMMA LJM925, Chile, Nazca Ridge, 40,0 mm.*

**Type locality:** *F. graciliformis*: Japan. *F. sieboldi*: Japan. *F. valdiviae*: Somalia, between Ras Hafun and Djibouti, approximately 400 m deep.

**Material examined:** The holotypes of *F. graciliformis* and *F. sieboldi*, and all the type material of *F. valdiviae*.

Madagascar, southwest Madagascar, Tulear, 500-800 m, collected by commercial boats, 4 dd, B. Briano; 1 dd, RH. – West Madagascar, off Morondava, 600 m, collected by commercial boats, 3 dd, KF; 2 dd, RH. – North Madagascar, 12° 52' 0" S, 48° 10' 3" E, 420-428 m, 1 dd juv; 12° 42' 9" S, 48° 12' 1" E, 445-455 m, 1 dd juv.

Philippines, south Bohol, Balicasag Island, off Panglao, 380 m, 1 lv, KF 2819. – Bohol, Balicasag, 275 m, 1 lv, C. Takahashi; 1 lv, B. Rogers. – North Mindanao, north of Dipolog, Aliguay Island, deep water, 3 lv, KF 3200; 2 lv, RH.

**Description:** Medium-sized shell (42.5-90.0 mm) with about 9-11 convex whorls, surrounded by a weak subsutural concavity. Suture appressed to preceding whorl, not incised.

Protoconch broken or eroded in all examined specimens and therefore unknown.

Eight or nine rather strong and narrow axial ribs, reaching from suture to suture and separated by narrow and not very deep impressed interspaces on the 2 uppermost teleoconch whorls. On the following 2 or 3 whorls the number of ribs increases up to 11-13 per whorl, becoming somewhat broader and lower and usually stopping below the upper suture; interspaces between ribs become shallower and less distinct. On antepenultimate or penultimate whorl the axial ribs become very low and less distinct and the spacing becomes irregular. Axial ribs always obsolete on body whorl and usually also on penultimate whorl.

Teleoconch begins with 5 or 6 strong but low and rounded spiral cords. Starting with the second or third whorl an additional clearly finer spiral cord appears just below suture, and a fine intercalated spiral thread appears between each pair of cords. On the following whorls the number of fine spiral threads increases by intercalation; up to 5 or 6 between each pair of primary cords on body whorl. In the subsutural concavity only some fine threads. The spiral sculpture is crossed by rather strong and well-visible curved growth lines, giving the surface of the shell the texture of linen.

Aperture ovate, whitish to yellowish in colour, acute at posterior end. Parietal

callus thin, smooth and glossy, appressed to lower part of body whorl. Columellar folds absent. Outer lip simple and thin, sculptured with numerous fine internal lirae; outline of lip strikingly curved like an elongated reversed 'S'. Siphonal canal shorter than aperture length, conspicuously curved. Outer side ornamented with numerous fine, low and regularly spaced spiral cords which are intercalated by numerous fine spiral threads.

Operculum corneous, colour pale reddish brown, thin, shape and size corresponding to aperture. Outer side with fine concentric growth lines. Typical of genus, with terminal nucleus.

Periostracum thin, olive-green, not hairy.

Radula (Fig. 87) typical of genus. Central tooth nearly rectangular, tricuspid, median cusp somewhat stronger. Lateral teeth strongly curved, with 6 or 7 long, strong and pointed cusps; outermost one much larger than all others. At both ends of lateral tooth with a small denticle.

**Range and habitat:** Japan (Bōsō peninsula and southwards), East China Sea, Philippines, South China Sea (HIGO ET AL., 1999: 263), and along the East African coast, from the Gulf of Aden, Djibouti, Somalia (HADORN AND FRAUSSEN, 1999: 120) to southwestern Madagascar. Between 50 and 1134 m deep, on sandy bottom.

**Remarks:** Comparing both the holotypes of *F. graciliformis* (Figs. 14-15) and *F. sieboldi* (Figs. 16-17) shows, that the latter is doubtless a junior synonym. Both holotypes are nearly identical in size, shape, sculpture and both were found in Japan.



*F. valdiviae* (Figs. 20-21) appears to be conspecific, the description based on subadult East African specimens. HADORN AND FRAUSSEN (1999) compared *F. valdiviae* with *F. westralis* (described in this paper) misidentified in the 1999 paper as *F. chryso-domoides*. After examination of the holotype of *F. graciliformis* and other material mainly from the Philippines we treat the conchologically not distinguishable *F. valdiviae* from East Africa provisionally as

a junior synonym of *F. graciliformis*. Further study can reveal a subspecific status for *F. valdiviae*. The radula of *F. graciliformis* is still unknown, the radula of *F. valdiviae* was figured by HADORN AND FRAUSSEN (1999, Fig. 87).

*F. hyphalus* differs from *F. graciliformis* by having a more slender spire tip, a smaller adult size, a thinner and lighter shell, and by the less convex whorls.

*Fusinus (Chryseofusus) hyphalus* M. Smith, 1940 (Figs. 22, 23)

*Fusinus hyphalus* M. Smith, 1940. *The Nautilus*, 54 (2): 43, pl. 2, fig. 9.

SUBSEQUENT USE.

*Fusinus (Simplicifusus) hyphalus* M. Smith, 1940. KIRA (1962: 85).

*Simplicifusus hyphalus* (M. Smith, 1940). HIGO ET AL. (1999: 263).

**Type material:** Holotype in M. Smith's collection (36.5 x 12.5 mm) (not seen).

**Type locality:** Japan, off Tosa, 183 m deep.

**Material examined:** Taiwan, deep water, 1 lv juv/1 lv, RH. – Keelung, 1 lv/1 dd subad, RH.

**Description:** Shell entirely white or pale, medium-sized (36.0-75.0 mm), thin, lightweight, fusiform, elongate, consisting of about 8 or 9 slightly convex whorls with only slight subsutural concavity. Body whorl often inflated and ventricose in adult specimens. Suture indistinct, straight.

Protoconch typical of genus,  $1\frac{1}{2}$  whorls, bulbous, white, glossy, final part ( $\frac{1}{4}$  whorl) sculptured with 4 or 5 strong axial riblets, diameter 1.0-1.1 mm.

Weak, narrow and inconspicuous axial ribs on upper 5 or 6 teleoconch whorls, separated by narrow interspaces, disappearing on latter whorls. 10 or 11 axial ribs on the 4 uppermost teleoconch whorls extending from suture to suture, 11-13 on fifth or sixth whorl, becoming weaker and disappearing on the following whorl.

Teleoconch beginning with 3 relatively weak primary spiral cords, the 2 lower ones slightly stronger. From second whorl on, a fine secondary spiral thread appears between primary cords and below suture, becoming as strong as the primary cords on following whorls. From fourth postnuclear whorl on, 2-4

fine intercalated tertiary threads appear between primary and secondary cords. Axial growth lines fine but distinct on all whorls, crossing spiral sculpture and giving the surface a pearled appearance.

Aperture ovate, whitish, relatively large. Edge of outer lip simple, slightly crenulated, internal side smooth or with some weak internal lirae. Inner lip smooth, glossy, parietal callus appressed to parietal wall, columellar folds absent. Siphonal canal thin, slightly curved, as long as aperture, open.

Periostracum thin, persistent, straw-brown in colour.

Operculum typical of genus, corneous, brown, shape and size corresponding to aperture, nucleus terminal.

**Range and habitat:** Japan, Enshu-nada and westwards, East China Sea at 100-300 m on sandy bottom (HIGO ET AL., 1999: 263); Philippines, Cebu and Bohol (SPRINGSTEEN AND LEOBRERA, 1986: 177).

**Remarks:** *F. hyphalus* resembles *Simplicifusus noguchii*, but belongs to *Fusinus* because of the typical fusinid operculum. *Simplicifusus noguchii* differs from *F. hyphalus* by having a smaller adult size, a more slender white-coloured shell, and by the presence of



axial ribs usually on all whorls, stronger on upper whorls, becoming weaker on body whorl, and by the small, nearly round operculum, which is typical of *Simplicifusus* (Fig. 2).

*F. graciliformis* can be distinguished by the larger adult size, the longer spire, the more convex whorls, and by often having rather strong, broad axial ribs on upper whorls.

*Fusinus* (*Chryseofusus*) *subangulatus* (von Martens, 1901) (Figs. 24-27, 77)

*Fusinus?* *subangulatus* von Martens, 1901. *Sitz.-Ber. Ges. Nat. Freunde Berlin*, Jahrg. 1901: 21.

SUBSEQUENT USE

*Fusinus subangulatus* von Martens. VON MARTENS (1904: 102-103, pl. 2, fig. 11).

*Fusinus subangulatus* (von Martens, 1903). HADORN AND FRAUSSEN (1999: 112-117, pl. 1, figs. 1-8, text fig. 1, non pl. 2, figs. 9-10 = *Fusinus jurgeni* Hadorn and Fraussen, 2002).

**Type material:** Lectotype ZMB 59931, VALDIVIA (71.1 × 23.7 mm, dd), designated by HADORN AND FRAUSSEN (1999). – 3 paralectotypes ZMB, south Somalia, near Kismaayo, VALDIVIA stn 253, 0° 27' S, 42° 47' E, 638 m (71.3 × 25.4 mm, lv); south Somalia, near Mogadisho, VALDIVIA stn 256, 1° 49' N, 45° 29' E, 1134 m (37.1 mm, spire fragment, dd); Tanzania, Pemba Channel, VALDIVIA stn 246, 5° 24' S, 39° 19' E, 818 m (39.9 × 14.5 mm, incomplete specimen with heavy incrustations, dd).

**Type locality:** South Somalia, near Kismaayo, VALDIVIA stn 254, 0° 29' S, 42° 47' E, 977 m.

**Material examined:** Lectotype and the 3 paralectotypes in ZMB.

Somalia, deep water, 3 dd, KF; 1 dd, RH. – Between Ras Hafun and Djibouti, 400 m, 1 dd, KF; 1 dd, RH.

*Description:* Shell rather large (up to 77.2 mm), relatively heavy in weight. Background colour whitish to yellowish with pale reddish coloured spiral sculpture. 9 or 10 convex whorls, latter whorls distinctly keeled, shoulder slope clearly concave. Axial and spiral sculpture rather weak. Aperture relatively large, siphonal canal short and distinctly curved. Protoconch broken in all known specimens. Suture appressed to the preceding whorl, wavy on upper whorls, straight on penultimate and body whorl.

Upper postnuclear whorls slightly convex, sculptured with 9 or 10 narrow and rather weak axial ribs, reaching from suture to suture; interspaces between them narrow and only weakly impressed. Beginning at the appearance of the peripheral keel (usually on fourth or fifth teleoconch whorl) the interspaces between the axial ribs become wider; the ribs terminate below the upper suture and are reduced to broad, rounded knobs which are most prominent at the periphery. On the penultimate whorl they become weaker and

irregular, fading out suddenly. About 9-13 axial knobs on latter whorls, but usually obsolete on body whorl and sometimes also on penultimate whorl.

Four strong spiral cords on the first teleoconch whorl, 5 or 6 on the following whorls. On latter whorls, beginning with the peripheral keel, several rather fine additional spiral threads appear on shoulder. Starting with third or fourth postnuclear whorl a fine spiral thread appears between each pair of stronger cords. The number of fine threads increases by intercalation; up to 8 fine intercalated threads of unequal strength on body whorl. Central spiral cord and the 2 cords below it somewhat stronger than all others. Spiral sculpture crossed by conspicuously strong growth lines, well-visible on all whorls.

Aperture rather large, narrowly ovate, acute at posterior end, yellowish or white in colour. Outer lip simple and sharp, without or with only weak internal lirae. Inner lip appressed to parietal wall, smooth. Columellar folds absent. Siphonal canal rather short for genus, shorter than aperture length, slightly

curved, widely open. Outer side ornamented with fine spiral cords and numerous intercalated threads.

Operculum rather thin, colour pale reddish brown, corneous. Shape and size corresponding to aperture, typical of genus, with terminal nucleus.

Radula (Fig. 77) typical of the genus, consisting of an elongated central tooth with a tricuspid base. Median cusp clearly longest. Rounded base broader than notched top. Lateral teeth conspicuously broad, strongly curved with 7-8 rather short, strong and pointed cusps; 2 outermost cusps broader and stronger.

*Range and habitat:* East Africa, from Djibouti, Gulf of Aden to the Pemba Channel, Tanzania, 400-1134 m deep on blue silt and pteropod ooze.

*Remarks:* Rediscovered by HADORN AND FRAUSSEN (1999), the typically

fusinid radula was figured for the first time (Fig. 77). A specimen from off the Somalian coast figured on pl. 2, figs. 9-10 as *F. subangulatus* "broad form" is now referred to *F. jurgeni* Hadorn and Fraussen, 2002.

*F. jurgeni* has a larger adult size and has a broader shell, a longer siphonal canal, a larger number of spiral cords which are clearly finer and denser.

*F. chrysodomoides* is most similar to *F. subangulatus* and can be distinguished by having a somewhat larger adult size, uncoloured spiral cords, a larger number of weaker spiral cords, often broader and somewhat stronger axial ribs, a more ventricose body whorl, stronger axial growth lines, usually a more curved siphonal canal and finally some minor differences in radula morphology.

### *Fusinus (Chryseofusus) bradneri* (Drivas and Jay, 1990) (Figs. 28-31, 78)

*Siphonofusus bradneri* Drivas and Jay, 1990. *Venus*, 49 (4): 272-273, pl. 1, fig. 6.

SUBSEQUENT USE

*Peristernia caledonica* (Petit, 1851). DRIVAS AND JAY (1998: 39, sp. 27).

*Fusinus bradneri* (Drivas and Jay, 1990). FRAUSSEN (1999: 81); HADORN AND FRAUSSEN (1999: 117, 120).

**Type material:** Holotype in MNHN (54.0 x 18.0 mm, dd). – 4 paratypes (46.6-77.5 mm, dd), from the type locality, in the collections of Jean Drivas and Maurice Jay.

**Type locality:** West coast of Reunion Island, St. Paul's Bay, 750 m.

**Material examined:** Holotype in MNHN.

Comoro Islands, Mayotte, east Passe Longogori, BENTHEDI 1977 stn 33, 12° 53' 5" S, 45° 16' 3" E, 275-400 m, 1 dd.

Glorieuses, west Grande Glorieuse, BENTHEDI 1977 stn 98, 11° 35' 5" S, 47° 16' 4" E, 280-460 m, 1 dd (dwarf form).

North Madagascar, 12° 42' 4" S, 48° 14' 1" E, 375-380 m, 1 lv.

Reunion, Baie de la Possession, 600 m, 1 lv/2 dd. – Off Saint-Gilles, 700 m, 3 dd. – Reunion, Campagne MD32 stn CA70, 21° 23' 01" S, 55° 29' 03" E, 700-730 m, 1 dd; stn CP129, 20° 51' S, 55° 36' E, 290-300 m, 1 dd juv; stn DR62, 21° 09' S, 55° 12' E, 630-710 m, 1 dd juv; stn DC134, 20° 51' S, 55° 39' E, 650-750 m, 1 dd juv; stn CP144, 20° 50' S, 55° 35' E, 605-620 m, 1 lv juv. – Reunion, west coast, St. Paul, 750-800 m, 1 dd, KF 2746; 5 dd, RH. – Reunion, off St. Paul's Bay, 750-800 m, 1 lv, KF.

*Description:* Shell fusiform, medium sized (46.6-77.5 mm), solid, consisting of 7 or 8 convex teleoconch whorls with subsutural concavity. Suture indistinct, appressed to the preceding whorl, wavy on axially ribbed part of spire, straight on latter whorls. Reddish-brown coloured, the stronger spirals and below the suture darker.

Protoconch pale, typically fusinid.

About 7 strong, conspicuously broad axial ribs separated by wide interspaces on upper whorls, disappearing on penultimate whorl.

Four strong primary spiral cords on upper teleoconch whorls; from fourth whorl on an intercalated secondary fine spiral thread between primary cords, soon becoming as strong as primary ones on antepenultimate whorl. At the same

time 1-3 clearly weaker tertiary intercalated threads appear on body whorl.

Fine, but well-visible growth lines intersect the spiral sculpture giving the surface a finely granulate appearance.

Aperture whitish, relatively small, ovate, pinched at both ends. Outer lip relatively thick in adult specimens, weakly denticulate, sculptured with numerous close-set and distinct internal lirae. Columellar callus smooth, adherent. Columellar folds absent.

Siphonal canal long, rather narrow, slightly curved.

Operculum typical of genus, corneous, reddish-brown, shape and size corresponding to aperture, nucleus terminal.

Radula (Fig. 78) typical of genus. Tricuspid elongate central tooth. Cusps strong, long and pointed, projecting below the base, central one somewhat stronger. The rounded top is narrower than the base. Lateral teeth have 5 strong pointed cusps with incurved tips. Outermost one clearly the strongest. With a small denticle at both ends.

*Range and habitat:* Reunion (300-750 m deep), north Madagascar (375-380 m), Glorieuses (280-460 m) and Comoro Islands (275-400 m). Previously only known from Reunion. Live collected specimens between 380 and 750 m deep, dead shells between 300 and 750 m.

*Remarks:* Described as a *Siphonofusus* (Buccinidae), but referred to *Fusinus* by HADORN AND FRAUSSEN (1999) on the basis of conchological resemblance to *F. valdiviae* (a junior synonym of *F. graciliformis*), *F. westralis* sp. nov. (misidentified as "*F. chrysodomoides*") and *F. subangulatus*. The generic position was still not confirmed because of the unknown radula. A juvenile specimen of *F. bradneri*, stored in MNHN, had the dried

animal preserved inside the shell. The radula (Fig. 78) is found to be typical of the genus *Fusinus* and the placement in Fasciolaridae is therefore correct.

*F. chrysodomoides* most closely resembles *F. bradneri*, but differs in having a slightly larger number of axial ribs on upper teleoconch whorls, in the narrower axial ribs and the narrower interspaces, the weak or absent lirae inside the aperture, in the uniformly whitish or greyish colour of the shell, in the usually shorter and less twisted siphonal canal, and finally in different radula morphology (more elongated and narrower central tooth, smaller number of cusps on lateral teeth).

*F. graciliformis* differs by having a somewhat larger and thinner shell, a larger number of narrower axial ribs on upper whorls with narrower interspaces, an aperture with weaker and indistinct internal lirae, and a uniformly white or rarely flesh coloured shell.

One probably dwarf specimen (Figs. 30-31) from the Glorieuses Islands (BENTHEDI stn 98) clearly has a shorter shell, a shorter spire and a shorter siphonal canal, a less constricted suture and less convex whorls. More material and study is necessary to conclude if this is a dwarf form or a distinct species.

DRIVAS AND JAY (1998: 39, sp. 27) figured a specimen of *Chryseofusus* misidentified as *Peristernia caledonica* (Petit, 1851). We examined two syntypes of *Turbinella caledonica* Petit, 1851 in MNHN [Type locality: New Caledonia] and found out, that the identification made by Drivas and Jay could definitively not be correct. We consider the figured shell a juvenile *F. bradneri*, because of the close resemblance to the juvenile material collected during the Campagne MD32 1982 near Reunion.

*Fusinus* (*Chryseofusus*) *jurgeni* Hadorn and Fraussen, 2002 (Figs. 34-37, 81)

*Fusinus subangulatus* (von Martens, 1903) "broad form". HADORN AND FRAUSSEN (1999: 115, pl. 2, figs. 9-10; 116).

*Fusinus* cf. *bradneri* Drivas and Jay, 1990. MALLARD (2001: 12, fig. 12).

*Fusinus jurgeni* Hadorn and Fraussen, 2002. *Iberus*, 20 (1): 67-76, figs. 9-14, 20 (radula).



**Type material:** Holotype (94.2 x 31.7 mm, lv) and one paratype (83.4 x 30.1 mm, dd) in MNHN, 5 paratypes in NM L5693/T1875 (89.7 x 32.6 mm, dd), KF (84.0 x 30.4 mm, dd), RH (89.1 x 31.0 mm, 76.5 x 26.6 mm, both dd), B. Rogers (90.5 x 32.2 mm, dd).

**Type locality:** Southwest Madagascar, Mozambique channel, 22° 22' S, 43° 03' E, 530 m.

**Material examined:** The live-taken holotype, collected by R. von Cosel during a shrimp stock survey by the commercial trawler *Mascareignes III* in 1986.

Madagascar, southwest Madagascar, Tulear, 500-800 m, collected by commercial boats, 5 paratypes MNHN, NM L5693/T1875, KF, RH; 4 dd, B. Briano; 1 dd, RH. – Southwest Madagascar, off Tulear, deep water, 1 dd, paratype B. Rogers. – West Madagascar, off Morondava, 600 m, 3 dd, KF 3208. Somalia, trawled between Ras Hafun and Djibouti, 400 m, 1 dd, KF 1631.

**Description:** Shell large (up to 100.1 mm), fusiform, light in weight, spire elongate, siphonal canal relatively long for subgenus. 11 or 12 convex whorls, latter whorls often slightly keeled, shoulder slope concave. Shell uniformly white, sometimes with reddish-brown tinged spiral cords and with some weak reddish brown axial strikes.

Protoconch typically fusinid, consisting of 1 to 1 1/4 smooth, glossy whorls. Transition to teleoconch eroded and details not recognizable. Diameter 0.9-1.0 mm.

Eight or nine rather narrow and weak axial ribs on 3 uppermost teleoconch whorls, extending from suture to suture. 8-10 axial ribs on following whorls, withdrawing from upper suture. Axial sculpture weak or absent on penultimate whorl. Body whorl without axial sculpture. Interspaces narrow on upper whorls, slightly broader and less pronounced on latter whorls.

Spiral sculpture crossed by strong, curved axial growth lines. 3 strong spiral cords on first teleoconch whorl, the uppermost weaker. From second whorl on, a fine intercalated secondary spiral thread appears. From fifth or sixth whorl on, secondary spirals becoming as strong as primary ones and additional fine tertiary spiral threads appear. On latter whorls 3-5 intercalated fine threads visible between stronger spirals.

Aperture rather large, ovate, upper end pointed, white coloured. Outer lip simple and smooth, without internal lirae. Inner lip completely smooth, curved. Parietal callus thin, parietal wall covered with an extended adherent layer of callus. Columellar folds absent. Siphonal canal almost straight or slightly curved, as long as aperture.

Operculum typically fusinid, corneous, ovate, pointed below, dark brown, shape and size corresponding to aperture, with terminal nucleus. Outer side ornamented with strong concentric growth lines; inner side with a strongly callused edge along the outer side.

Periostracum unknown.

Radula (Fig. 81) typical of genus. Central tooth almost rectangular in shape; base slightly convex, top straight or slightly concave, both sides concave, tricuspid, with strong, short, pointed cusps projecting below base. Lateral teeth elongate, curved, with 7 strong, long, pointed cusps. At both ends with a small denticle.

**Range and habitat:** Known from southwestern Madagascar, between 500 and 800 m deep. One live collected specimen 530 m deep. One record from Somalia, collected between Ras Hafun and Djibouti, 400 m deep (KF 1631).

**Remarks:** *F. subangulatus* has a somewhat smaller and heavier shell, a smaller number of whorls, a more slender shape, a shorter siphonal canal and a stronger spiral sculpture with a smaller number of spiral cords.

*F. chrysodomoides* differs in being usually smaller, in having a heavier and stouter shell, a less constricted suture, a sometimes brownish coloured aperture and a uniformly coloured shell, and a spiral sculpture with a more beaded appearance.

*F. bradneri* differs by its smaller size, the more solid and reddish brown coloured shell, the less constricted suture, the broad and strong axial ribs on upper whorls, the strong close-set lirae inside the aperture, and by having a smaller number of intercalated fine threads between the stronger spiral cords.



*Fusinus* (*Chryseofusus*) *kazdailisi* Fraussen and Hadorn, 2000 (Figs. 32-33, 79)

*Fusinus kazdailisi* Fraussen and Hadorn, 2000. *Novapex*, 1 (1): 15-19, figs. 1-12.

**Type material:** Holotype in KMMA LJM925 (40.0 x 17.0 mm, lv). – Chile, Nazca Ridge, Ecliptic Bank, 110-150 m (56.0 x 23.0 mm, dd, paratype 1, H. Danila; 57.0 x 23.0 mm, dd, paratype 2, KF; 48.0 x 20.0 mm, dd, paratype 3, RH; 43.0 x 18.0 mm, lv, paratype 4, MNHN). – Chile, Nazca Ridge, Mesyatev Bank, 260-280 m (45.0 x 19.0 mm, lv, paratype 5, KF). – Chile, off Valparaiso, 1200 m (52.0 x 22.0 mm, lv, paratype 6, A. Nora; 51.0 x 20.0 mm, lv, paratype 7, KF). – unknown locality (47.0 x 19.0 mm, lv, paratype 8, C. and J. Hemmen; 57.0 x 22.0 mm, lv, paratype 9, Haus der Natur, Cismar, Germany; 48.0 x 20.0 mm, lv, paratype 10, Haus der Natur, Cismar, Germany).

**Type locality:** Off Chile, Nazca Ridge, Ecliptic Bank, in deep water.

**Material examined:** Holotype in KMMA and all paratypes.

Chile, Nazca Ridge, Ecliptic Bank, 110-150 m, 1 dd, KF; 1 lv, RH.

Unknown locality, 1 dd, RH; 1 dd, KF 2944; 1 dd, R. Kelly.

**Description:** Shell medium sized (40.0-57.0 mm), solid, shape fusiform, semi-slender. Whorls about 6 in number, showing a weak subsutural concavity. Suture appressed to preceding whorl. Shell dirty greyish to brown or pale reddish-brown. Protoconch missing in all known specimens.

Eight to fourteen rather strong and narrow axial ribs, traversing from suture to suture, on upper whorls. Interspaces rather narrow. Axial ribs become weaker on following whorls and finally disappear. All whorls densely covered with fine, sometimes slightly curved growth lines, often not visible on their own but recognizable by low papillae formed on spiral cords, giving the surface of latter whorls a pearled appearance.

Seven to nine strong and rounded primary spiral cords on first remaining teleoconch whorl, separated by deep and narrow interspaces. On second whorl, interspaces become broader, tending to be similar in size to spiral cords. 9 or 10 primary spiral cords on following whorl, 12-14 on penultimate whorl. On third or fourth whorl 1 fine intercalated secondary spiral thread appears between each pair of primary cords. Furthermore, 1 or 2 additional intercalated tertiary spiral threads between secondary and primary cords on lower part of penultimate whorl.

Aperture narrowly ovate to lens-shaped. Parietal callus thin, smooth and glossy, appressed to body whorl. Columellar folds absent. Outer lip thin. Siphonal canal broad, shorter than aperture, oblique at left-hand side and straight.

Operculum corneous, thin and pale reddish-brown, shape and size corresponding to aperture, with terminal nucleus.

Periostracum thin, olive-green in colour.

Radula (Fig. 79) typical of genus. Central tooth tricuspid, median cusp strongest, occasionally with 1 or 2 small additional denticles situated near middle of cusp. Lateral teeth strongly curved, with 6 or 7 long and pointed cusps mostly of equal size. A small denticle occasionally appears at both ends of lateral tooth.

**Range and habitat:** Described from Nazca Ridge and from off Valparaiso, Chile. On mud and muddy sand in deep water between 150 and 1200 m.

**Remarks:** *Aeneator castillai* McLean and Andrade, 1982, a buccinid species, is similar in sculpture and colour, but can be distinguished by the larger size, the broader shape, the more ventricose body whorl, the clearly larger aperture, and finally the buccinid radula.

*Fusinus* (*Chryseofusus*) *acherusius* sp. nov. (Figs. 38-43, 80)

**Type material:** Holotype (58.6 x 22.6 mm, lv) and one paratype (48.0 x 20.9 mm, lv) in MNHN, 1 paratype RH (52.3 x 21.4 mm, dd).

**Type locality:** West Madagascar, Mozambique Channel, stn CH126, 17° 50' S, 43° 07' E, 1475-1530 m.

**Material examined:** The live taken holotype and the paratype in MNHN from the type locality. Madagascar, west Madagascar, Mozambique Channel, 18° 00' S, 43° 00' E, 1715-1750 m, 1 dd, paratype RH. – Northwest Madagascar, Mozambique Channel, stn CH131, 13° 46' S, 47° 33' E, 1490-1600 m, 1 lv.

South New Caledonia, BIOCAL stn CP27, 23° 06' S, 166° 26' E, 1850-1900 m, 1 dd.

**Etyymology:** "acherusius" (Latin, adjective), meaning "from the underworld" and "sombre, dreary".

**Description:** Shell medium sized (up to 58.6 mm), dirty grey, rather heavy, body whorl short, spire high, consisting of about 8 carinated whorls which are appressed to preceding one. Shoulder slope straight or slightly concave.

Protoconch decollated in all available specimens.

Upper teleoconch whorls with about 12 rather weak axial ribs, which are most prominent at periphery. Interspaces shallow, as broad as ribs. Ribs slightly more numerous (up to 17) on latter whorls, withdrawing from upper suture and becoming simultaneously weaker, gradually fading away towards body whorl. Usually without axial ribs on body whorl.

Four or five strong spiral cords on upper teleoconch whorls. Central one somewhat stronger, forming a distinct carina on all whorls. From early whorls on, 1 fine intercalated secondary thread appears between each pair of stronger primary cords. On body whorl often becoming as strong as primary ones. Spiral sculpture crossed by numerous unequal close-set axial growth lines giving surface the texture of linen.

Aperture elongate, narrow, white to yellowish. Outer lip sharp, simple, finely crenulated. Posterior canal well developed, without internal lirae. Inner lip smooth, without callus and columellar folds. Siphonal canal short, slightly

longer than half of aperture length, widely open, strongly curved to the left and slightly curved backwards.

Periostracum thin, light brownish, well-adherent.

Operculum typical of genus, brown coloured, corneous, size and shape corresponding to aperture, with terminal nucleus.

Radula (Fig. 80) fusinid, central tooth tricuspid, somewhat atypical for *Fusinus*, extremely narrow, elongated, with a strong central cusp and 1 rudimentary, reduced, hardly visible small cusp at both sides of the central one. Lateral teeth typical of genus, slightly curved, base broad, with 7 rather short pointed cusps.

**Range and habitat:** West Madagascar, Mozambique Channel, 1530-1715 m deep. One single record (Figs. 42, 43) from south New Caledonia, 1850-1900 m deep.

**Comparison:** *F. kazdailisi* from off the Chilean coast most closely resembles *F. acherusius*, but can be separated by having weaker and more numerous axial ribs on upper teleoconch whorls, no axial ribs on penultimate whorl, non-carinated whorls, a narrower and straight siphonal canal, and finally a different radula (central tooth nearly round with 3 well-developed cusps, the central one occasionally with 1 or 2 small additional denticles).

### *Fusinus (Chryseofusus) artutus* sp. nov. (Figs. 44-47, 82)

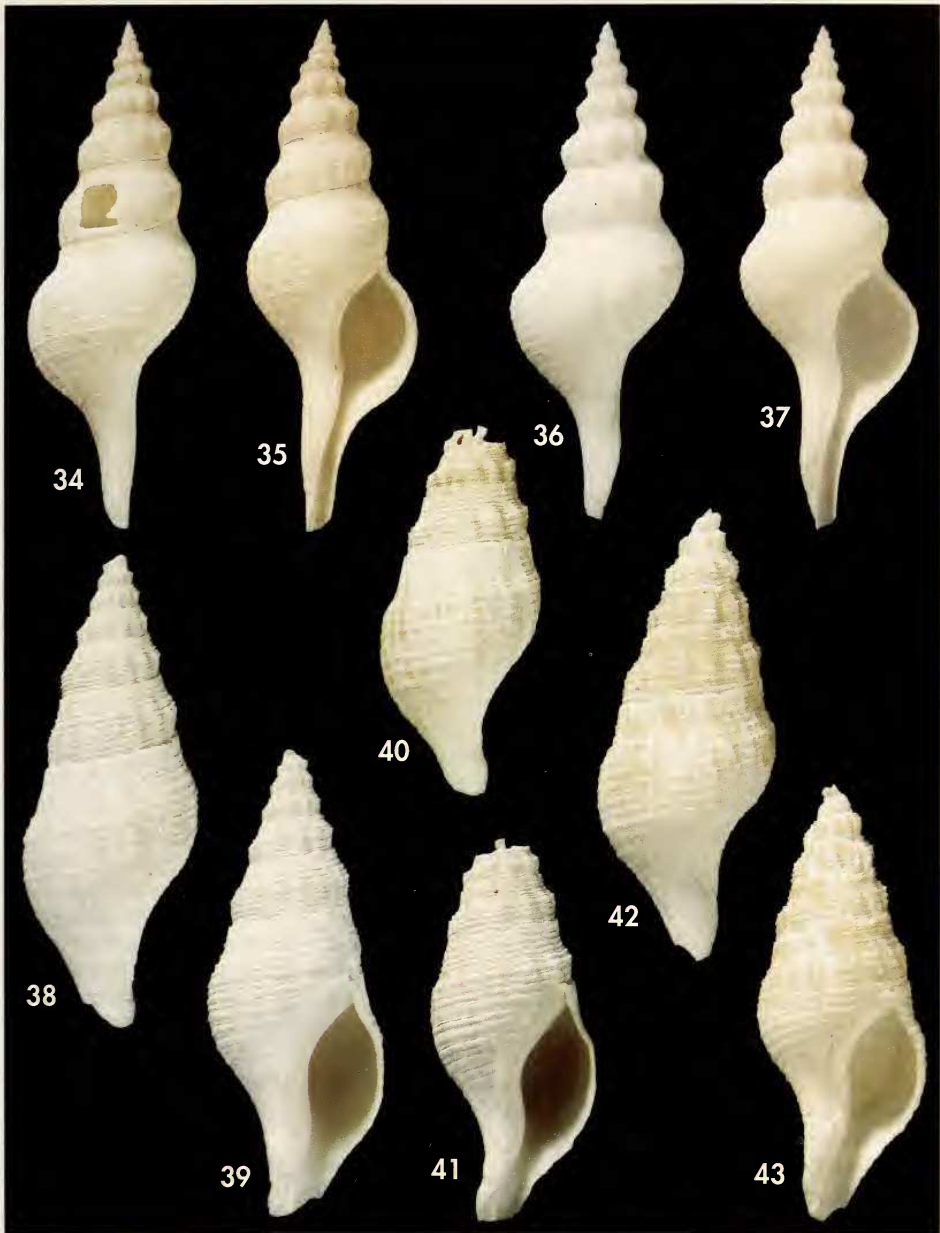
**Type material:** Holotype NM L2083 (72.2 x 26.0 mm, dd) in NM, paratype 1 (59.5 x 23.2 mm, lv), B. Rogers.

**Type locality:** Philippines, Bohol, Panglao, 200 m deep.

**Material examined:** Holotype and paratype both from the type locality, collected by local fishermen. Indonesia, Tanimbar Islands, KARUBAR stn CP46, 08° 01' S, 132° 51' E, 271-273 m, 1 lv subad.

New Caledonia, BIOCAL stn DW08, 20° 34' S, 166° 54' E, 435 m, 1 lv/2 dd juv.

**Etyymology:** Named after the Latin expression "artutus" (adjective), meaning "strongly built" (or "sturdy", "solid", "firm"), remembering the broad and solid shell.



Figures 34-37. *Fusinus* (*Chryseofusus*) *jurgeni* Hadorn and Fraussen, 2002. 34, 35: Holotype MNHN, southwest Madagascar, 94.2 mm; 36, 37: Paratype MNHN, southwest Madagascar, Tulear, 83.4 mm. Figures 38-43. *Fusinus* (*Chryseofusus*) *acherusius* sp. nov. 38, 39: Holotype MNHN, west Madagascar, Mozambique Channel, 58.6 mm; 40, 41: Paratype MNHN, west Madagascar, Mozambique Channel, 48.0 mm; 42, 43: MNHN, south New Caledonia, 35.5 mm.

*Figuras 34-37. Fusinus (Chryseofusus) jurgeni* Hadorn y Fraussen, 2002. 34, 35: Holotipo MNHN, SE de Madagascar, 94,2 mm; 36, 37: Paratipo MNHN, SO de Madagascar, Tulear, 83,4 mm. Figuras 38-43. *Fusinus (Chryseofusus) acherusius* sp. nov. 38, 39: Holotipo MNHN, O de Madagascar, Mozambique Channel, 58,6 mm; 40, 41: Paratipo MNHN, O de Madagascar, Mozambique Channel, 48,0 mm; 42, 43: MNHN, S de Nueva Caledonia, 35,5 mm.



*Description:* Shell up to 72.2 mm, fusiform, stout, with broad spire angle, 9 or 10 convex, shouldered whorls with slight subsutural concavity. Suture wavy, following axial sculpture of preceding whorl on ribbed upper part of the spire, straight on lower whorls. Spire tip white, latter whorls flesh coloured, inside aperture light brownish or whitish.

Protoconch rather large, white, 1 to 1 <sup>1</sup>/<sub>4</sub> whorls, smooth and glossy, sometimes with axial growth lines on final part, ending in a varix. 1.0 mm in diameter.

Strong, close-set axial ribs on upper teleoconch whorls, traversing from suture to suture. Interspaces narrow and deep. About 9-11 narrow and distinct ribs on upper whorls, suddenly becoming lower and broader, and fading away on penultimate whorl.

Teleoconch begins with 4 strong spiral cords. 2 additional cords appear on second whorl: one immediately below suture, the other just above lower suture. From third whorl on, a fine secondary spiral thread appears between each pair of primary cords, becoming soon as strong as primary ones. In addition very fine intercalated tertiary spirals appear. This fine spiral sculpture is crossed by strong close-set axial growth lines, giving the surface the texture of linen.

Aperture ovate, white or light brownish coloured. Outer lip thin, edge

slightly crenulated, inside smooth or inconspicuously lirate. Parietal callus thin, smooth, columellar folds absent. Siphonal canal rather short, about as long as aperture, curved, slightly bending backwards.

Periostracum thin, greenish, well-adherent.

Operculum typically fusinid, reddish-brown, corneous, shape and size corresponding to aperture, with terminal nucleus.

Radula typically fusinid (Fig. 82). Central tooth small, broad, top and both sides concave, base convex, tricuspid, cusps of about equal size, projecting below base. Lateral teeth curved, having 6 or 7 rather small, short, pointed cusps with incurved tips. Small denticle at inner end.

*Range and habitat:* Philippines, Bohol, 200-540 m deep. One record from Indonesia, Tanimbar Islands, 271-273 m deep, and one record from New Caledonia, 435 m deep.

*Comparison:* *F. chrysodomoides* has a less constricted suture, a white to brownish shell, coarser and less numerous axial ribs on upper whorls, and a finer, more close-set spiral sculpture.

*F. graciliformis* has a more elegant shell with elongate spire, a larger adult size, less ventricose, less convex and longer whorls, and has a weaker spiral sculpture with a larger number of intercalated fine threads on body whorl.

### *Fusinus (Chryseofusus) dapsilis* sp. nov. (Figs. 48, 49)

*Type material:* Holotype (74.1 x 29.2 mm, dd) in MNHN.

*Type locality:* Vietnam, deep water, not accompanied by detailed data.

*Material examined:* The holotype is the only specimen known, and originates from material traded by Russian collectors in the late 1980s – early 1990s.

*Etymology:* Named after the Latin expression “dapsilis” (adjective), meaning “precious” “expensive”, remembering the golden colour.

*Description:* Shell 74.1 mm, reddish-brown, fusiform, thin, light in weight but solid. Whorls convex and ventricose, surrounded by distinct subsutural concavity.

Protoconch and spire tip broken leaving 6 <sup>1</sup>/<sub>4</sub> remaining whorls. Original

number of teleoconch whorls 9 or 10 by estimation.

Upper part of spire covered with 10 or 11 rounded, dense, relatively strong axial ribs, extending from suture to suture, suddenly fading away on antepenultimate whorl. Last 3 whorls smooth, except for



strong, curved axial growth lines crossed by weak close-set spiral threads, giving surface the texture of linen.

Four rather strong spiral cords on uppermost remaining whorl; subsutural cord somewhat weaker. On next whorl, a fine intercalated secondary thread appears between each pair of primary cords, becoming as strong as primary ones on antepenultimate whorl. Up to 3 tertiary, clearly finer intercalated threads appear between the strong primary and secondary cords on penultimate and body whorl. Spiral sculpture crossed by strong growth lines, giving the spirals a pearly appearance.

Aperture rather large, light purplish coloured. Outer lip simple, thin, edge minutely crenulated; interior side smooth. Parietal wall covered with a thin, glossy and smooth callus, somewhat extending outside aperture. Col-

umellar folds absent. Siphonal canal conspicuously short, broad, open and strongly curved.

Periostracum, protoconch and radula unknown.

*Range and habitat:* Only known from the South China Sea, off Vietnam. No precise information about locality and habitat available.

*Comparison:* *F. chryseofusus* differs from *F. dapsilis* by the heavier shell, the broader and less close-set axial ribs and the longer siphonal canal.

*F. bradneri* has a smaller adult size, is more elegant and has a more elongate spire, a longer and narrower siphonal canal, and the inside of the aperture is strongly liriate. Moreover, the axial sculpture on upper teleoconch whorls consists of strong, broad axial ribs, and the stronger spiral cords are reddish-brown in colour.

### *Fusinus* (*Chryseofusus*) *riscus* sp. nov. (Figs. 50-53, 83)

**Type material:** Holotype (19.1 x 8.3 mm, lv subad) and one paratype (18.9 x 8.9 mm, lv) in MNHN, 4 paratypes in AMS C.205150 (21.5 x 9.7 mm, dd), NMNZ M.273192 (19.4 x 8.4 mm, dd), RH (21.4 x 9.3 mm, lv subad), KF (19.3 x 8.3 mm, lv subad).

**Type locality:** South New Caledonia, Norfolk Ridge, BATHUS 3 stn DW818, 23° 44' S, 168° 16' E, 394-401 m.

**Material examined:** The live collected holotype, the 5 paratypes, and 8 specimens (2 dd/3 lv subad/3 dd juv) from the type locality.

South New Caledonia, Norfolk Ridge, BATHUS 3 stn DW817, 23° 42' S, 168° 16' E, 405-410 m, 11 dd/5 dd juv/3 lv/2 lv juv. – South New Caledonia, BERYX 11 stn CP21, 24° 44' S, 168° 07' E, 430-450 m, 2 dd.

**Etymology:** The name is derived from the Latin "riscus" (noun, masculine), meaning a rotan box. *F. riscus* resembles a rotan box in surface sculpture (fine spiral sculpture crossed by strong growth lines giving surface the texture of linen).

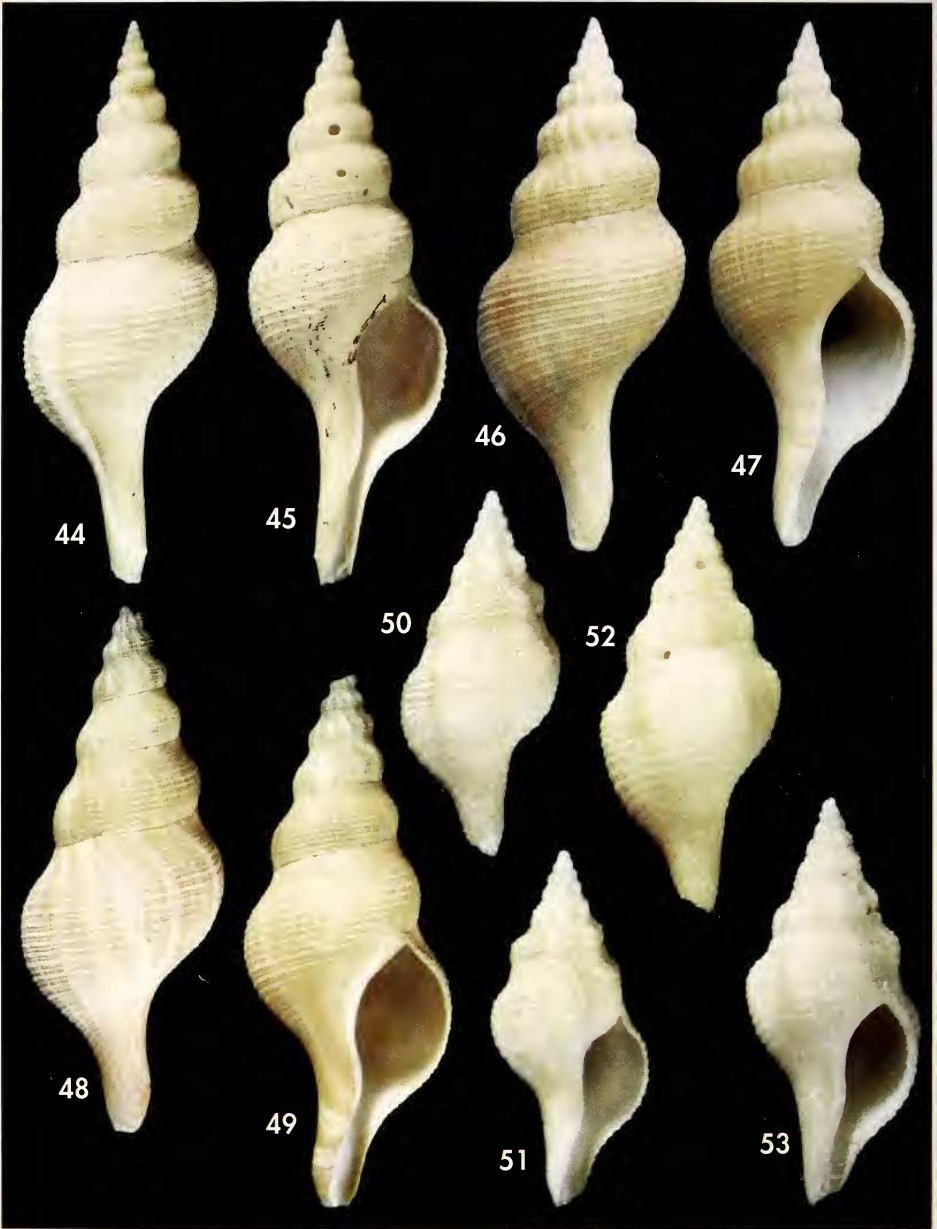
*Description:* Shell small for genus (up to 21.5 mm), fusiform, thick, whitish to yellowish, consisting of 7 or 8 convex, slightly carinated whorls, appressed to preceding whorl, surrounded by a distinct subsutural concavity. Suture wavy, inconspicuous.

Protoconch consisting of 1 whorl, white, transparent, glossy, smooth, final part (about  $\frac{1}{4}$  whorl) with some very fine axial growth lines and 2 or 3 weak spiral threads; transition to teleoconch indistinct. 0.6-0.8 mm in diameter.

Axial sculpture consists of broad, low knobs on all whorls, separated by wide

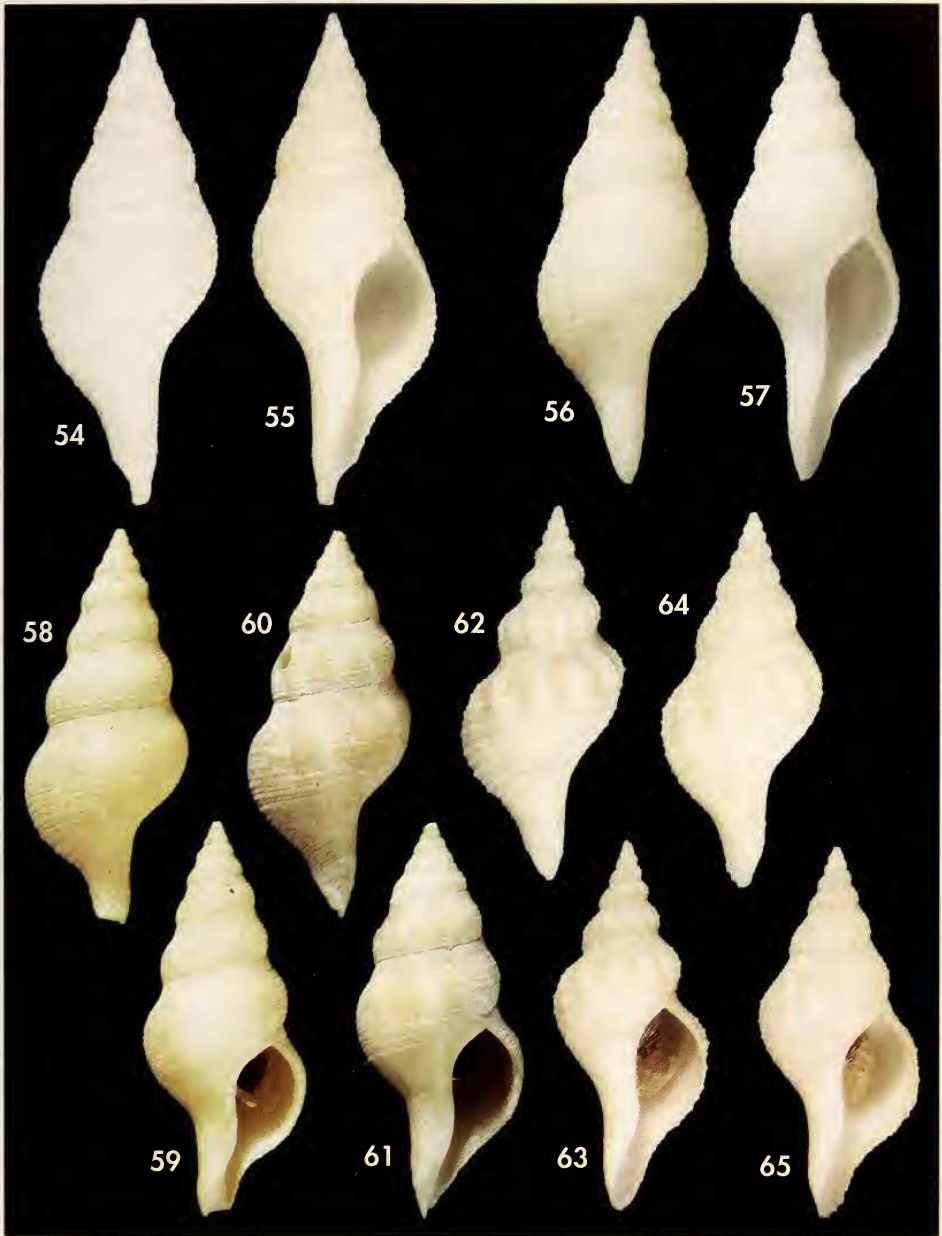
and low interspaces. On upper teleoconch whorls 7 or 8 ribs traversing from suture to suture, on latter whorls 5 or 6 shorter ribs abapically prominent, often somewhat irregular on body whorl.

Teleoconch begins with 4 spiral cords, abapical ones clearly stronger. On fourth or fifth teleoconch whorl, a fifth strong spiral cord appears just above lower suture, stronger when crossing axial knobs and weak in interspaces. Number of spirals increasing by intercalation on latter whorls, secondary ones becoming as strong as primary ones on penultimate and body whorl. On body whorl fine ter-



Figures 44-47. *Fusinus (Chryseofusus) artutus* sp. nov. 44, 45: Holotype NM L2083, Philippines, Bohol, Panglao, 72.2 mm; 46, 47: Paratype B. Rogers, Philippines, Bohol, Panglao, 59.5 mm. Figures 48, 49. *Fusinus (Chryseofusus) dapsilis* sp. nov., Holotype MNHN, Vietnam, 74.1 mm. Figures 50-53. *Fusinus (Chryseofusus) riscus* sp. nov. 50, 51: Holotype MNHN, New Caledonia, Norfolk Ridge, 19.1 mm; 52, 53: MNHN, New Caledonia, Norfolk Ridge, 24.8 mm.

Figuras 44-47. *Fusinus (Chryseofusus) artutus* sp. nov. 44, 45: Holotipo NM L2083, Filipinas, Bohol, Panglao, 72,2 mm; 46, 47: Paratipo B. Rogers, Filipinas, Bohol, Panglao, 59,5 mm. Figuras 48, 49. *Fusinus (Chryseofusus) dapsilis* sp. nov., Holotipo MNHN, Vietnam, 74,1 mm. Figuras 50-53. *Fusinus (Chryseofusus) riscus* sp. nov. 50, 51: Holotipo MNHN, Nueva Caledonia, Norfolk Ridge, 19,1 mm; 52, 53: MNHN, Nueva Caledonia, Norfolk Ridge, 24,8 mm.



Figures 54-57. *Fusinus* (*Chryseofusus*) *cadus* sp. nov. 54, 55: Holotype MNHN, south New Caledonia, 35.5 mm; 56, 57: MNHN, south New Caledonia, 30.5 mm. Figures 58-61. *Fusinus* (*Chryseofusus*) *alisae* sp. nov. 58, 59: Holotype MNHN, north New Caledonia, 29.6 mm; 60, 61: Paratype MNHN, New Caledonia, 27.5 mm. Figures 62-65. *Fusinus* (*Chryseofusus*) *scissus* sp. nov. 62, 63: Holotype MNHN, south New Caledonia, 33.0 mm; 64, 65: Paratype MNHN, south New Caledonia, 31.1 mm. *Figuras 54-57. Fusinus* (*Chryseofusus*) *cadus* sp. nov. 54, 55: *Holotipo* MNHN, *S de Nueva Caledonia*, 35,5 mm; 56, 57: MNHN, *S de Nueva Caledonia*, 30,5 mm. *Figuras 58-61. Fusinus* (*Chryseofusus*) *alisae* sp. nov. 58, 59: *Holotipo* MNHN, *N de Nueva Caledonia*, 29,6 mm; 60, 61: *Paratipo* MNHN, *Nueva Caledonia*, 27,5 mm. *Figuras 62-65. Fusinus* (*Chryseofusus*) *scissus* sp. nov. 62, 63: *Holotipo* MNHN, *S de Nueva Caledonia*, 33,0 mm; 64, 65: *Paratipo* MNHN, *S de Nueva Caledonia*, 31,1 mm.



tiary threads appear at both sides of secondary spirals. Spiral sculpture crossed by conspicuously strong growth lines giving surface the texture of linen.

Aperture small, ovate, white coloured. Outer lip slightly crenulated, simple. Conspicuously strong, broad internal lirae. Parietal callus appressed, smooth, columellar folds absent. Siphonal canal shorter than aperture length, straight, widely opened. Periostracum light brownish, rather thick.

Operculum brownish, typical of genus, shape and size corresponding to aperture, with terminal nucleus.

Radula typical of *Fusinus* (Fig. 83). Central tooth large, elongate, almost

oblong with slightly concave sides, tricuspid. All 3 cusps conspicuously strong and pointed, clearly projecting below base. Central cusp the strongest. Lateral teeth curved, 4-6 strong, long and pointed cusps with incurved tips. At both ends with a small pointed denticle.

*Range and habitat:* Southern New Caledonia, between 401 and 430 m deep.

*Comparison:* *F. cadus* and *F. alisae*, both described later in this paper, have a larger adult size, clearly narrower and more axial ribs on upper whorls, and usually a ribless penultimate and body whorl.

### *Fusinus (Chryseofusus) cadus* sp. nov. (Figs. 54-57, 84)

**Type material:** Holotype (35.5 x 13.4 mm, dd) and 1 paratype (22.3 x 8.9 mm, lv juv) in MNHN, 4 paratypes in AMS C.205151 (26.9 x 10.3 mm, dd subad), NMNZ M.273193 (25.7 x 11.0 mm, dd), RH (23.9 x 9.8 mm, lv subad), KF (19.8 x 8.0 mm, dd juv).

**Type locality:** South New Caledonia, BERYX 11 stn DW27, 23° 37' S, 167° 41' E, 460-470 m.

**Material examined:** The holotype, 1 paratype MNHN and 6 specimens (dd) from the type locality, all in MNHN.

North New Caledonia, MUSORSTOM 4 stn DW162, 18° 35' S, 163° 10' E, 525 m, 1 dd juv. – BATHUS 4 stn DW908, 18° 58' S, 163° 11' E, 502-527 m, 1 dd.

South New Caledonia, BERYX 11 stn DW38, 23° 38' S, 167° 39' E, 550-690 m, 5 dd/1 lv subad/1 dd juv; stn DW39, 23° 37' S, 167° 40' E, 490-500 m, 2 dd juv. – SMIB 3 stn DW12, 23° 38' S, 167° 42' E, 470 m, 2 dd. – BIOCAL stn DW33, 23° 10' S, 167° 10' E, 675-680 m, 1 lv juv/2 dd juv; stn CP52, 23° 06' S, 167° 47' E, 540-600 m, 1 dd subad, paratype AMS C.205151. – CHALCAL 2 stn DW76, 23° 41' S, 167° 45' E, 470 m, 2 dd juv/1 lv subad, paratypes RH and KF. – MUSORSTOM 4 stn DW221, 22° 59' S, 167° 37' E, 535-560 m, 1 dd juv; stn DW229, 22° 51' S, 167° 13' E, 445-460 m, 1 dd, paratype NMNZ M.273193.

**Etymology:** The name is derived from the Latin "cadus" (noun, masculine), meaning a small terracotta bottle. *F. cadus*, small and with subsutural concavity, also resembles pottery in colour.

*Description:* Shell small (up to 35.5 mm), whitish to light brownish, consisting of 8 whorls. Whorls convex, with slight subsutural concavity. Suture indistinct.

Protoconch porcellaneous white, swollen, smooth and glossy, consisting of 1 whorl. Final part (about 1/4 whorl) sometimes with some fine axial riblets. 0.7-0.9 mm in diameter.

On upper teleoconch whorls, 8 or 9 strong, broad, low axial ribs, traversing from suture to suture, somewhat narrower at upper end. Interspaces half as wide as the axial ribs. Axial sculpture suddenly fading out on antepenultimate or penultimate whorl.

Four strong spiral cords on upper teleoconch whorls. From third whorl on, a fine spiral thread appears between primary ones. On fifth whorl, up to 3 fine intercalated tertiary spirals appear and secondary spirals become as broad as the primary ones. Spiral sculpture weak, crossed by numerous well-visible close-set growth lines giving surface the texture of linen.

Aperture narrowly ovate, white, pointed at both ends, with numerous weak internal lirae. Outer lip thin, finely crenulated. Parietal callus thin, smooth, appressed, columellar folds absent. Siphonal canal slightly curved, somewhat shorter than aperture.

Periostracum light brownish, thick.

Operculum typical of genus, corneous, brown, shape and size corresponding to aperture, with terminal nucleus.

Radula typically fusinid (Fig. 84), central tooth rather large, almost ovate (top and base convex, both sides straight or slightly concave), with 3 prominent cusps projecting below base. Central cusp somewhat stronger than the others. Lateral teeth curved, with 6 prominent long cusps with incurved tips. Outermost one the broadest and strongest. With a small denticle at both ends.

*Range and habitat:* From north New Caledonia to south New Caledonia (18° 35' S, 163° 10' E to 23° 41' S, 167° 47' E), between 460 and 675 m deep.

*Comparison:* *F. riscus* has a smaller adult size, less numerous and much

broader axial ribs with broad interspaces on upper whorls, and has the penultimate and body whorl axially ribbed.

*F. alisae* is similar in size and sculpture, but has a larger number of narrower axial ribs, more convex whorls, the upper whorls increase their diameter much more rapidly, and different radula morphology (lateral teeth with more and clearly shorter cusps, and the central tooth has a narrower, concave top and more concave sides and oblique cusps at both sides of the central one).

Juvenile specimens of *F. wareni* are also similar in shape and sculpture, but the whorl diameter increases more rapidly and the spire is less extended. *F. wareni* has more axial ribs per whorl, adult shells are clearly larger in size and have more whorls.

### *Fusinus (Chryseofusus) alisae* sp. nov. (Figs. 58-61, 85)

**Type material:** Holotype (29.6 × 12.1 mm, dd) and 1 paratype (27.5 × 11.8 mm, dd) in MNHN, 4 paratypes in AMS C.205152 (26.4 × 11.0 mm, dd), NMNZ M.273194 (27.4 × 12.5 mm, dd), RH (35.5 × 15.5 mm, dd), KF (20.8 × 9.6 mm, dd).

**Type locality:** North New Caledonia, BATHUS 4 stn DW927, 18° 56' S, 163° 22' E, 444-452 m.

**Material examined:** The holotype, 1 paratype MNHN and 14 specimens (9 dd juv/5 lv juv) from the type locality.

Coral Sea, Chesterfield Islands, MUSORSTOM 5 stn 361, 19° 53' S, 158° 38' E, 400 m, 3 dd juv; stn 378, 19° 54' S, 158° 38' E, 355 m, 2 dd juv; stn 379, 19° 53' S, 158° 40' E, 370-400 m, 1 dd juv.

North New Caledonia, SMIB 6 stn DW118, 18° 58' S, 163° 26' E, 290-300 m, 1 dd, paratype RH; stn DW119, 18° 59' S, 163° 26' E, 295-305 m, 1 dd, paratype NMNZ M.273194; stn DW121, 18° 58' S, 163° 26' E, 315 m, 1 lv/1 dd/1 dd juv; stn DW122, 18° 58' S, 163° 25' E, 325-330 m, 2 lv subad; stn DW123, 18° 57' S, 163° 25' E, 330-360 m, 1 dd, paratype AMS C.205152. – BATHUS 4 stn DW923, 18° 52' S, 163° 24' E, 470-502 m, 3 dd juv; stn DW924, 18° 55' S, 163° 24' E, 344-360 m, 3 dd; stn DW925, 18° 55' S, 163° 24' E, 370-405 m, 4 dd juv; stn DW926, 18° 57' S, 163° 25' E, 325-330 m, 1 dd/2 dd juv; stn CP928, 18° 55' S, 163° 24' E, 420-452 m, 1 dd/1 dd juv; stn DW931, 18° 55' S, 163° 24' E, 360-377 m, 1 lv juv/3 dd; stn DW940, 19° 00' S, 163° 26' E, 305 m, 1 dd, paratype KF. – MUSORSTOM 4 stn CP194, 18° 53' S, 163° 22' E, 545 m, 3 dd juv; stn DW181, 18° 57' S, 163° 22' E, 350 m, 4 dd juv; stn DW196, 18° 55' S, 163° 24' E, 450 m, 2 dd juv.

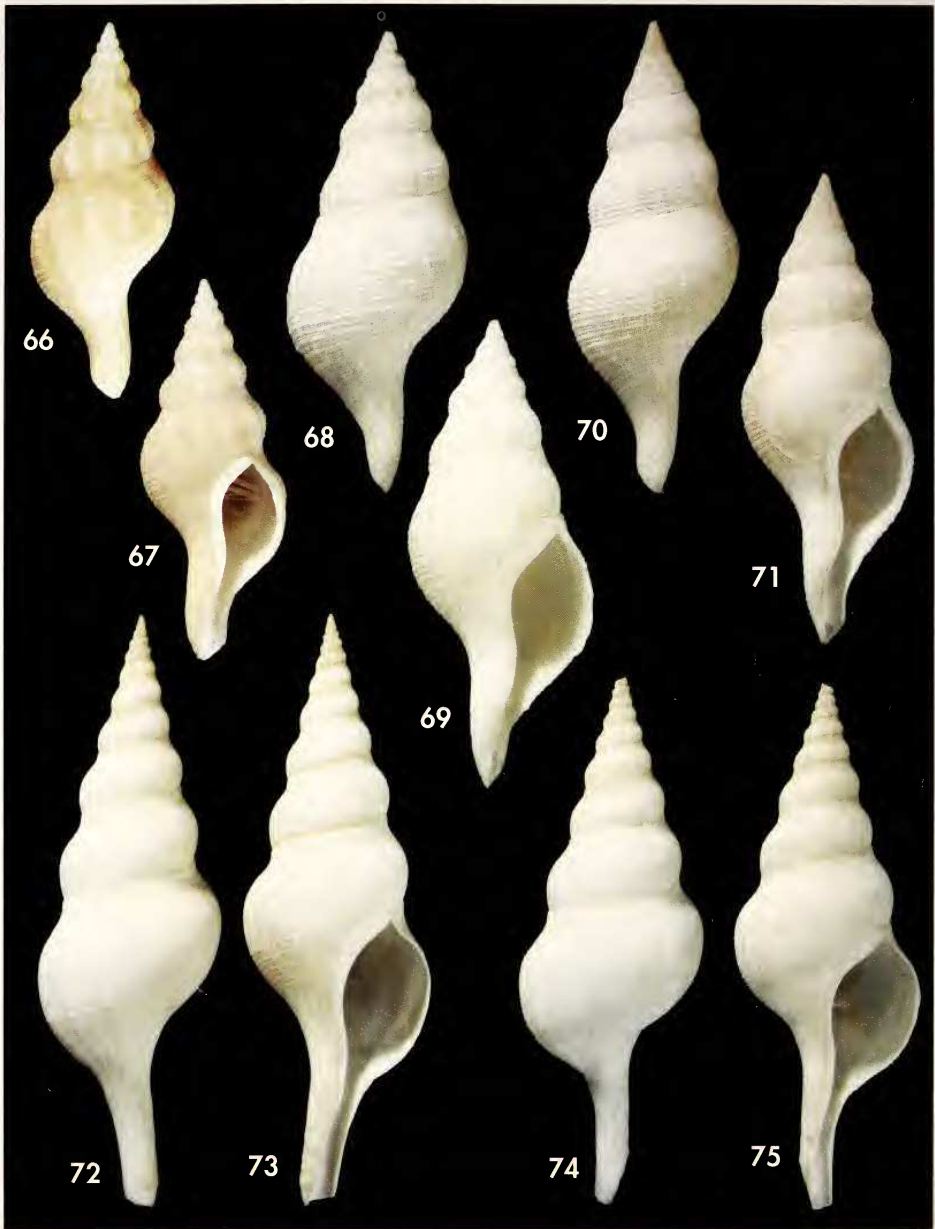
**Etymology:** Named after the French research vessel "Alis", which collected most of the known specimens during the cruises BATHUS 4 and SMIB 6.

*Description:* Shell small (up to 35.5 mm), whitish to light brownish, fusiform, 7 or 8 convex whorls with subsutural concavity. Upper whorls slightly bicarinate. Diameter of upper whorls increasing more rapidly than lower ones.

Protoconch whitish, consisting of 1 1/4 whorls. Upper part smooth and

glossy, last part (about 1/4 to 1/2 whorl) sculptured with some narrow but strong axial riblets. 0.7-1.0 mm in diameter.

Axial ribs traversing from suture to suture on upper whorls, withdrawing from upper suture on latter whorls. 9-12 rather weak, narrow ribs on 2 uppermost teleoconch whorls, separated by conspicuously narrow interspaces. 10-14



Figures 66, 67. *Fusinus (Chryseofusus) scissus* sp. nov., MNHN, south New Caledonia, 32.1 mm. Figures 68-71. *Fusinus (Chryseofusus) wareni* sp. nov. 68, 69: Holotype MNHN, New Caledonia, 59.5 mm; 70, 71: Paratype MNHN, New Caledonia, 50.0 mm. Figures 72-75. *Fusinus (Chryseofusus) westralis* sp. nov., northwest Australia, Rottmest Island. 72, 73: Holotype WAM S10876, 114.4 mm; 74, 75: Paratype MNHN, 113.3 mm.

*Figuras 66, 67. Fusinus (Chryseofusus) scissus sp. nov., MNHN, S de Nueva Caledonia, 32,1 mm. Figuras 68-71. Fusinus (Chryseofusus) wareni sp. nov. 68, 69: Holotipo MNHN, Nueva Caledonia, 59,5 mm; 70, 71: Paratipo MNHN, Nueva Caledonia, 50,0 mm. Figuras 72-75. Fusinus (Chryseofusus) westralis sp. nov., NO de Australia, Rottmest Island. 72, 73: Holotipo WAM S10876, 114,4 mm; 74, 75: Paratipo MNHN, 113,3 mm.*



ribs on following 2 or 3 whorls, latter whorls usually without ribs. Large adult specimens sometimes with conspicuously strong axial knobs on body whorl.

Teleoconch begins with 4 spiral cords. 2 adapical ones clearly stronger from beginning and forming a weak, inconspicuous double keel on upper whorls, fading away on latter whorls. From second or third postnuclear whorl on, a fine intercalated thread appears between each pair of primary cords. Number of fine threads increasing up to 2 by intercalation on latter whorls. Rather weak spiral sculpture crossed by prominent axial growth lines giving surface the texture of linen.

Aperture ovate, whitish, pointed at both ends. Outer lip slightly crenulated, simple. About 18 rather fine internal lirae. Inner lip smooth, parietal callus thin, collemellar folds absent. Siphonal canal shorter than aperture, slightly curved.

Periostracum light brown, rather thin.

Operculum corneous, brownish, typical of genus, shape and size corresponding to aperture, with terminal nucleus.

Radula typical of genus (Fig. 85). Central tooth small, short. Base convex,

broad, with 3 prominent cusps of about equal size projecting below base; top narrow, concave; both sides strongly convex. Lateral teeth curved, having 6 or 7 short pointed cusps of about equal size and a small pointed denticle at both ends.

*Range and habitat:* North of New Caledonia and Coral Sea, Chesterfield Islands, between 300 and 545 m deep.

*Comparison:* *F. riscus* differs in being smaller, having less convex whorls, a clearly smaller number of much broader axial ribs with broader interspaces on upper whorls, an axially ribbed penultimate and body whorl and differences in radula morphology (clearly larger, elongate central tooth, a smaller number of much longer cusps on lateral teeth) and a different protoconch (only one whorl, sculptured with fine axial growth lines and 2 or 3 weak spiral threads on final part).

*F. cadus* differs in the less numerous and broader axial ribs, less convex whorls, the upper whorls increasing in diameter slower than in *F. alisae*, the last part of the protoconch is smooth or has some fine axial riblets, and has a different radula morphology (lateral teeth with less numerous but much longer cusps).

### *Fusinus (Chryseofusus) scissus* sp. nov. (Figs. 62-67, 88)

**Type material:** Holotype (33.0 x 14.5 mm, lv) and 2 paratypes (31.1 x 13.6 mm, lv; 33.4 x 15.9 mm, dd, siphonal canal broken) in MNHN, and 4 paratypes in AMS C.205153 (31.9 x 14.7 mm, lv), NMNZ M.273195 (29.9 x 13.8 mm, lv), RH (33.4 x 14.1 mm, lv), KF (27.2 x 11.4 mm, lv).

**Type locality:** South New Caledonia, SMIB 3 stn DW24, 22° 59' S, 167° 21' E, 535 m.

**Material examined:** The live taken holotype and all the paratypes from the type locality.

South New Caledonia, SMIB 1 stn DW2, 22° 52' S, 167° 13' E, 415 m, 1 lv/1 lv juv; stn DW7, 22° 56' S, 167° 16' E, 500 m, 1 dd juv. – SMIB 2 stn DW3, 22° 56' S, 167° 15' E, 412-428 m, 1 dd; stn DW4, 22° 53' S, 167° 13' E, 410-417 m, 1 dd juv; stn DW5, 22° 56' S, 167° 14' E, 398-410 m, 2 dd juv; stn DW6, 22° 56' S, 167° 16' E, 442-460 m, 1 dd juv; stn DW9, 22° 54' S, 167° 15' E, 475-500 m, 2 lv juv; stn DW10, 22° 55' S, 167° 16' E, 490-495 m, 3 lv/7 dd; stn DW17, 22° 55' S, 167° 15' E, 428-448 m, 1 lv; stn DW18b, 22° 58' S, 167° 20' E, 530-535 m, 3 lv/6 dd; stn DC26, 22° 59' S, 167° 23' E, 500-535 m, 1 lv/1 dd. – SMIB 3 stn DW21, 22° 59' S, 167° 19' E, 525 m, 1 lv/1 dd; stn DW22, 23° 03' S, 167° 19' E, 503 m, 3 lv juv/1 dd; stn DW23, 22° 58' S, 167° 20' E, 530 m, 1 lv/1 dd; stn DW26, 22° 55' S, 167° 16' E, 450 m, 1 dd juv. – SMIB 4 stn DW58, 23° 00' S, 167° 24' E, 480-560 m, 2 lv/1 dd; stn DW61, 23° 00' S, 167° 22' E, 520-550 m, 1 lv/1 dd; stn DW62, 23° 00' S, 167° 22' E, 490-540 m, 1 lv; stn DW63, 22° 59' S, 167° 21' E, 580 m, 1 dd; stn DW65, 22° 55' S, 167° 15' E, 400-420 m, 1 dd. – MUSORSTOM 4 stn CP214, 22° 54' S, 167° 14' E, 425-440 m, 1 dd; stn CP216, 22° 59' S, 167° 22' E, 490-515 m, 1 dd juv; stn DW222, 22° 58' S, 167° 33' E, 410-440 m, 1 dd. – BERYX 11 stn CP22, 24° 44' S, 168° 07' E, 490-510 m, 1 dd. – BIOCAL stn DW44, 22° 47' S, 167° 14' E, 440-450 m, 2 dd/22 dd juv; stn DW46, 22° 53' S, 167° 17' E, 570-610 m, 20 dd juv/4 lv juv. – BATHUS 2 stn DW719, 22° 48' S, 167° 16' E,

444-445 m, 2 lv/1 dd/15 dd juv; stn DW720, 22° 52' S, 167° 16' E, 530-541 m, 3 lv/24 dd/9 dd juv; stn DW721, 22° 54' S, 167° 17' E, 525-547 m, 3 lv/12 dd/26 dd juv/6 lv juv.

Ile des Pins, southeast Récif sud, SMIB 8 stns DW193-196, 22° 59' S-23° 00' S, 168° 21' E-168° 23' E, 491-558 m, 16 dd/18 dd juv; stn DW201, 22° 59' S, 168° 21' E, 500-504 m, 2 dd/1 dd juv.

Norfolk Ridge, SMIB 8 stn DW200, 24° 00' S, 168° 21' E, 514-525 m, 2 dd.

New Caledonia, 500 m, by local fisherman, 2 lv/3 dd, RH.

**Etymology:** "scissus" (Latin, adjective) means "wrinkled", describing the weak and close-set axial folds on all whorls.

**Description:** Shell small (up to 33.4 mm), fusiform, body whorl inflated, 8 whorls. Whorls convex, unkeeled or with an inconspicuous double keel, body whorl conspicuously ventricose. Colour uniformly white.

Protoconch large, 1.0 mm in diameter, smooth, whitish, consisting of 1<sup>1</sup>/<sub>4</sub> whorls; final part (about 1<sup>1</sup>/<sub>4</sub> whorl) sculptured with some fine axial riblets traversing from suture to suture. Ending in an indistinct varix.

Eleven to thirteen inconspicuous, weak, close-set axial folds on all whorls, traversing from suture to suture on upper whorls. Ribs withdrawing from upper suture on body whorl, becoming somewhat stronger, forming more or less prominent axial knobs at periphery.

Teleoconch beginning with 4 or 5 rather weak spiral cords. From second or third whorl on, fine intercalated secondary spiral threads appear between primary cords. Number increasing to 6 on latter whorls. 2 primary cords at periphery often somewhat stronger than others, forming sometimes an indistinct double keel.

Aperture large, ovate, pinched at upper end, white or cream coloured, often light brownish or purplish along edge on inner side of outer lip. Outer lip simple, slightly crenulated; inner side ornamented with close-set white lirae. Parietal callus thin, appressed to parietal wall, smooth and glossy. Columellar folds absent. Siphonal canal conspicuously short, broad, curved and widely open. Outer side sculptured with some rather weak spiral cords and up to 3 intercalated fine threads.

Periostracum straw coloured, thin.

Operculum typical of genus, corneous, light brown, shape and size corresponding to aperture, outer side sculptured with fine concentric growth lines, with terminal nucleus.

Radula typical of genus (Fig. 88). Central tooth tricuspid, middle cusp strongly developed, long and straight; cusps at both sides shorter with incurved tips. All cusps clearly project below base. Lateral teeth broad, curved, consisting of 5 or 6 strong, long, pointed cusps with incurved tips and with small denticle at both ends. Outermost cusp strongest and broadest.

**Range and habitat:** Only known from southern New Caledonia, 410-580 m deep.

**Comparison:** *F. scissus* can be distinguished from the other small southwest Pacific species *F. cadus*, *F. alisae* and *F. riscus* by the somewhat larger adult size, the large, ventricose body whorl, the larger aperture and the axially ribbed body whorl.

*Manaria insularis* Okutani, 1968, a species of uncertain generic position (see discussion under *F. chryseodomoides*), most closely resembles *F. scissus* in shape and size, but differs in having a light brown shell, a smaller number of whorls, indistinct axial ribs on body whorl, and by the clearly different spiral sculpture (close-set, strong, raised spiral cords, strong on the top of ribs, obscure in the interspaces, and by the presence of only one intercalated fine thread on penultimate and body whorl).

### *Fusinus (Chryseofusus) wareni* sp. nov. (Figs. 68-71)

**Type material:** Holotype (59.5 x 22.3 mm, dd) and 1 paratype in MNHN (50.0 x 20.1 mm, dd).

**Type locality:** New Caledonia, MUSORSTOM 4 stn CP170, 18° 57' S, 163° 13' E, 480 m.

**Material examined:** The holotype in MNHN.

New Caledonia, MUSORSTOM 4 stn CC201, 18° 56' S, 163° 14' E, 490 m, 1 dd, paratype MNHN. Loyalty Ridge, BATHUS 3 stn DW794, 23° 48' S, 169° 49' E, 751-755 m, 1 fragment. Tonga Islands, seamount south of Eua, BORDAU 2 stn DW1617, 23° 03' S, 175° 53' W, 483-531 m, 1 dd/1 dd juv.

**Etymology:** This species is named to honour Anders Warén (SMNH) for his contributions to malacology. The preparation of the radulae and SEM illustrations in this paper are his work.

*Description:* Shell medium sized (up to 59.5 mm), fusiform, uniformly whitish or brownish, consisting of about 9 rounded teleoconch whorls with slight subsutural concavity. Suture indistinct, whorls appressed to preceding one.

Protoconch white, bulbous, glossy, smooth, consisting of 1 1/4 whorls, ending in a varix. Diameter about 0.9-1.0 mm.

Uppermost 4 or 5 teleoconch whorls rather weakly axially ribbed. 10-12 low, broad ribs with narrow interspaces, reaching from suture to suture on first 3 whorls, withdrawing from upper suture on fourth or fifth postnuclear whorl. Lower whorls without axial ribs. All whorls ornamented with well-visible, close-set, curved growth lines, crossing the weak spiral cords and giving surface the texture of linen.

Teleoconch beginning with 4 or 5 spiral cords, adapically more prominent compared to upper ones. From third whorl on, a fine secondary spiral thread appears between each pair of primary cords. From fifth whorl on, 1 tertiary fine thread appears at both sides of secondary ones. From sixth whorl on, the secondary ones become as strong as primary ones. 2 or 3 fine intercalated spiral threads between stronger cords on body whorl.

Aperture ovate, pointed at both ends, white or flesh coloured, inner lip smooth. Parietal wall covered with a thin callus, becoming well-developed on columella. Columellar folds absent. Outer lip simple. Internal side sculptured with about 18-20 elongate, irregular and rather strong denticles. Siphonal canal about as long as aperture, strongly curved, rather narrow, open, tapering anteriorly. Outer side sculptured with close-set spiral cords and up to 3 fine intercalated spiral threads.

Periostracum, operculum and radula unknown.

*Range and habitat:* New Caledonia and Tonga Islands, between 480 and 751 m deep.

*Comparison:* *F. kazdailisi* is most similar to *F. wareni* in shape and sculpture but differs in having a somewhat smaller adult size, a dirty greyish to brown or pale reddish-brown colour, less numerous whorls, stronger and more pronounced axial ribs with more distinct interspaces, a smaller number of somewhat stronger spiral cords which are intercalated by 3-6 fine spiral threads on body whorl, and finally in having a broad and straight siphonal canal which is oblique to the left side.

*F. acherusius* has a heavier shell, carinated upper whorls, numerous pronounced axial ribs on most whorls, a rough spiral sculpture, rough growth lines of unequal strength, and a broader and shorter siphonal canal.

*F. alisae* has a smaller adult size, a whitish to light brownish colour, broader upper postnuclear whorls, a usually bicarinate profile of the upper whorls, a smaller protoconch, a subsutural concavity which is often more prominent, and an often larger number of axially ribbed whorls.

*F. cadus* also differs in having a clearly smaller adult size, a whitish to light brownish colour, a smaller protoconch with a smaller diameter, in having a less prominent subsutural concavity, a more slender shell, and a larger number of axially ribbed whorls.

*F. artutus* is similar in sculpture, but has a larger adult size, more convex whorls, a longer spire, a more constricted suture, a deeper subsutural concavity, and a longer siphonal canal.



*Fusinus (Chryseofusus) westralis* sp. nov. (Figs. 72-75)

*Siphonofusus chrysodomoides* (Schepman, 1911). – KOSUGE (1985: 59, pl. 23, fig. 7); WILSON (1994: 66, pl. 12, figs. 7a-b).

*Fusinus chrysodomoides* (Schepman, 1911). – HADORN AND FRAUSSEN (1999: pl. 3, figs. 17-18).

**Type material:** Holotype (114.4 x 36.2 mm, lv) in WAM S10876. 8 paratypes in MNHN (113.3 x 40.6 mm, lv), AMS C.205154 (99.3 x 34.0 mm, lv), NMNZ M.273196 (86.6 x 31.6 mm, lv), USNM (81.2 x 29.3 mm, lv), ZMA Moll. 4.03.005 (93.6 x 32.1 mm, lv), KF 3201 (123.5 x 40.2 mm, lv), RH (123.6 x 42.6 mm, lv), B. Rogers (114.1 x 38.4 mm, lv).

**Type locality:** Northwest Australia, Rottneest Island, 400-500 m deep.

**Material examined:** The live collected holotype and 8 paratypes from the type locality.

Northwest Australia, off Rottneest Island, 400-500 m deep, collected by commercial fishing boats, 33 lv, KF 3203; 1 lv, RH. – Off Port Hedland, deep water, 1 lv, KF3201; 1 lv, KF3202; 5 lv, RH.

**Etymology:** Named after Western Australia, which is the species present range. Also to remember *Perotrochus westralis* (Whitehead, 1987), a sympatric species.

**Description:** Shell large (up to 140 mm), light, thin, uniformly white, shape fusiform. 11-13 ventricose, unkeeled whorls, with wide subsutural concavity.

Protoconch white, glossy, consisting of 1 whorl, ending in a weak varix. Surface of protoconch slightly eroded and therefore no sculpture visible. 0.9 mm in diameter.

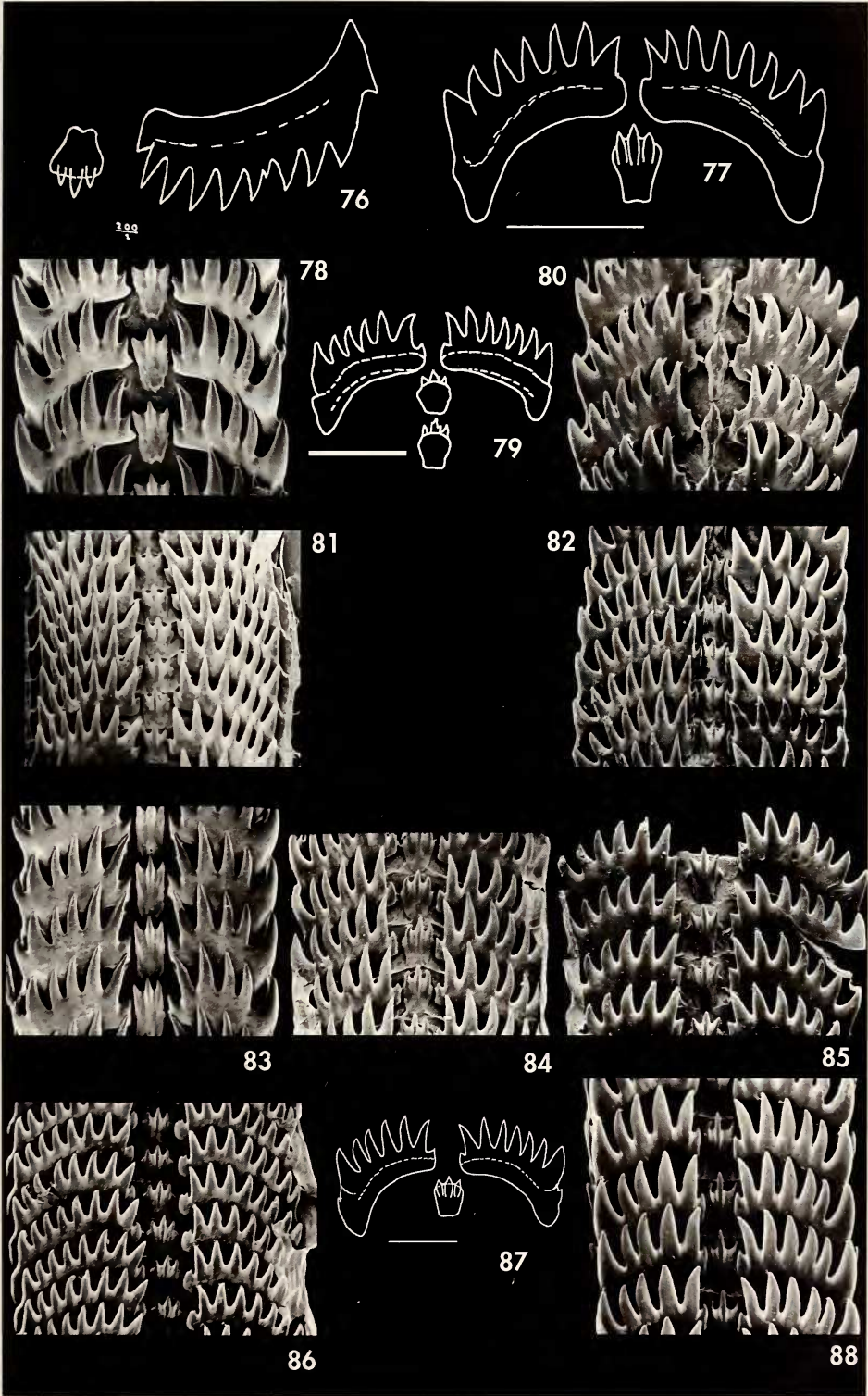
Nine to twelve rather weak, narrow axial ribs on 4 uppermost teleoconch whorls, reaching from suture to suture on first postnuclear whorl. Withdrawing from upper suture on second whorl. On third or fourth whorl ribs suddenly weaker, gradually fading away on following whorls. Growth lines curved, fine.

About 4 or 5 rather weak spiral cords on uppermost whorl. From second postnuclear whorl on, a fine intercalated secondary spiral thread appears between each pair of primary cords. On following whorls numerous fine and inconspicuous tertiary spiral threads appear. Lower whorls covered by conspicuously fine spiral sculpture, axial sculpture obsolete.

Aperture large, oval, pointed above, white. Parietal callus smooth and thin. Outer lip thin, simple, without internal lirae. Columellar folds absent. Siphonal canal shorter than aperture, rather broad, strongly curved and widely opened.

(Right page) Figures 76-88. Radulae. 76: *Fusinus (Chryseofusus) chrysodomoides* (Schepman, 1911), reproduced from SCHEPMAN (1911: fig. 10). 77: *Fusinus (Chryseofusus) subangulatus* (von Martens, 1901); 78: *Fusinus (Chryseofusus) bradneri* (Drivas and Jay, 1990), juvenile specimen; 79: *Fusinus (Chryseofusus) kazdailisi* Fraussen and Hadorn, 2000; 80: *Fusinus (Chryseofusus) acherusius* sp. nov.; 81: *Fusinus (Chryseofusus) jurgeni* Hadorn and Fraussen, 2002; 82: *Fusinus (Chryseofusus) artutus* sp. nov.; 83: *Fusinus (Chryseofusus) riscus* sp. nov.; 84: *Fusinus (Chryseofusus) cadus* sp. nov.; 85: *Fusinus (Chryseofusus) alisae* sp. nov.; 86: *Fusinus (Chryseofusus) chrysodomoides* (Schepman, 1911); 87: *Fusinus (Chryseofusus) graciliformis* (Sowerby, 1880), Holotype *Fusinus valdiviae* Hadorn and Fraussen, 1999 (junior synonym); 88: *Fusinus (Chryseofusus) scissus* sp. nov.

(Página derecha) Figuras 76-88. Rádulas. 76: *Fusinus (Chryseofusus) chrysodomoides* (Schepman, 1911), reproducido de SCHEPMAN (1911: fig. 10); 77: *Fusinus (Chryseofusus) subangulatus* (von Martens, 1901); 78: *Fusinus (Chryseofusus) bradneri* (Drivas y Jay, 1990), juvenil; 79: *Fusinus (Chryseofusus) kazdailisi* Fraussen y Hadorn, 2000; 80: *Fusinus (Chryseofusus) acherusius* sp. nov.; 81: *Fusinus (Chryseofusus) jurgeni* Hadorn y Fraussen, 2002; 82: *Fusinus (Chryseofusus) artutus* sp. nov.; 83: *Fusinus (Chryseofusus) riscus* sp. nov.; 84: *Fusinus (Chryseofusus) cadus* sp. nov.; 85: *Fusinus (Chryseofusus) alisae* sp. nov.; 86: *Fusinus (Chryseofusus) chrysodomoides* (Schepman, 1911); 87: *Fusinus (Chryseofusus) graciliformis* (Sowerby, 1880), Holotipo *Fusinus valdiviae* Hadorn y Fraussen, 1999 (sinónimo junior); 88: *Fusinus (Chryseofusus) scissus* sp. nov.



Operculum typical of genus, corneous, brown, ovate, pointed at lower end, shape and size corresponding to aperture, with terminal nucleus. Outer side ornamented with numerous concentric growth lines.

Periostracum and radula unknown.

*Range and habitat:* Only known from western Australia. WILSON (1994) reported this species as *Siphonofusus chrysodomoides* (Schepman, 1911) from off Rowley Shoals to Rottneest Island between 300-500 m deep.

*Comparison:* *F. westralis* has hitherto been identified and offered to collectors as "*Siphonofusus chrysodomoides*". Authors figured this species as *S. chrysodomoides* (KOSUGE, 1985; WILSON, 1994) and as *Fusinus chrysodomoides* (HADORN AND

FRAUSSEN, 1999). Wilson noted the generic allocation of this species provisional. Hadorn and Fraussen placed this species in *Fusinus* based on conchological resemblance with *F. valdiviae*. After studying the Indonesian type material of *Fusinus chrysodomoides* we describe the western Australian shells as *F. westralis*.

*F. westralis* differs from *F. chrysodomoides* by the larger shell size, the more slender and more extended spire tip, the larger number of whorls, the more concave shoulder slope especially on the lower whorls, the narrower interspaces between axial ribs on upper whorls, and finally by the much finer spiral sculpture and the much larger number of very fine intercalated spiral threads.

## BIOGEOGRAPHICAL DISCUSSION

The distribution of the 16 species of *Chryseofusus* probably partly reflects actual distribution patterns and sampling efforts. One species is known from the East Pacific (*kazdailisi*) and Western Australia (*westralis*), and these two species are not known from elsewhere. Five species are known from East and Southeast Asia (*chrysodomoides*, *graciliformis*, *hyphalus*, *artutus* and *dapsilis*), of which two (*hyphalus*, *dapsilis*) are not known from elsewhere. Six species are known from East Africa and the southwest Indian Ocean (*chrysodomoides*, *graciliformis*, *subangulatus*, *bradneri*, *acherusius* and *jurgeni*), of which three (*subangulatus*, *bradneri* and *jurgeni*) are not known from elsewhere. Finally, eight species are known from the SW Pacific (*chrysodomoides*, *acherusius*, *artutus*, *riscus*, *cadus*, *alisae*, *scissus* and *wareni*), of which five (*riscus*, *cadus*, *alisae*, *scissus*, *wareni*) are not known from elsewhere.

The highest diversity is encountered in New Caledonia, where all eight species known in the southwest Pacific co-occur, of which four (*riscus*, *cadus*, *alisae* and *scissus*) can be regarded as local. In the North of New Caledonia, up to three species (*cadus*, *alisae*, *wareni*) potentially occupy the same bathymetric horizon between 300 and 545 m

(whereas *chrysodomoides* occupies slightly deeper water), but none of them occurs syntopically with another species. In the South and on Norfolk Ridge, up to four species (*chrysodomoides*, *cadus*, *riscus*, *scissus*) potentially occupy the same bathymetric horizon between 401 and 675 m, and there is a single occurrence where two species have been taken together in the same haul (SMIB 1 stn DW2: *chrysodomoides*, *scissus*). The high diversity in the New Caledonia region thus apparently reflects high environmental heterogeneity as well as individual specific ecological preferences (Table I). The data for the southwest Indian Ocean are more scanty but tend to support the same conclusion: up to four (*chrysodomoides*, *graciliformis*, *bradneri* and *jurgeni*) occupy the same bathymetric horizon between 350 and 600 m in the Mozambique Channel, but we have no documented case of syntopy.

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P. Bouchet (MNHN), B. Richer de Forges (IRD, Nouméa) and A. Warén (SMNH) collectively collected most of the material on which this paper is based. V. Héros (MNHN) arranged for the loan of



Table I. Geographical and bathymetrical distribution of species of *Chryseofusus* in the New Caledonia region.

Tabla 1. Distribución geográfica y batimétrica de las especies de *Chryseofusus* en la región de Nueva Caledonia.

Species	Coral Sea	North New Caledonia	New Caledonia proper	Norfolk Ridge	Loyalty Ridge
<i>chrysodomoides</i>		610-705		415	577-600
<i>acherusius</i>				1850-1900	
<i>artutus</i>			435		
<i>cadus</i>		525		460-675	
<i>alisae</i>	355-400	300-545			
<i>riscus</i>				401-430	
<i>scissus</i>				410-580	
<i>wareni</i>		480-490			751-755

additional MNHN material, A. Warén prepared radulae and SEM illustrations, and P. Bouchet revised an earlier draft of the manuscript. We thank R. Moolenbeek (ZMA), J. Goud (RMNH), E. Gittenberger (RMNH), K. Way (BMNH), J. Pickering (BMNH), R. Kilburn (NM), H. Saito (NSMT), M. Gosteli (NMBE) and M. Glaubrecht (ZMB) for the loan of type material, S. Kosuge (IMT) for Japanese literature and translation, R. Houart (Belgium) for comments, corrections and

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**BIBLIOGRAPHY**

BIELER, R. AND PETIT, R. E., 1990. On the various editions of Tetsuaki Kira's "Coloured Illustrations of the Shells of Japan" and "Shells of the Western Pacific in Color, Vol. I", with an annotated list of new names introduced. *Malacologia*, 32: 131-145.

BIELER, R. AND PETIT, R. E., 1996. Additional notes on nomina first introduced by Tetsuaki Kira in "Coloured Illustrations of the shells of Japan". *Malacologia*, 38 (1-2): 33-34.

BOUCHET, P. AND WARÉN, A., 1986. Taxonomical notes on tropical deep water Buccinidae with descriptions of new taxa. Résultats des Campagnes Musorstom, volume 4. *Mémoires du Muséum National d'Histoire Naturelle*, ser. A, 133: 457-517.

BRUGUIÈRE, J. G., 1789. *Encyclopédie méthodique. Histoire naturelle des vers*. Vol. 1, part 1. Panckoucke, Paris, 344 pp.

CROSNIER, A., RICHER DE FORGES, B. AND BOUCHET, P., 1997. La campagne KARUBAR en Indonésie, au large des îles Kai et Tanimbar. In Crosnier, A. and Bouchet, P. (eds), Résultats des Campagnes Musorstom, volume 16. *Mémoires du Muséum national d'Histoire Naturelle*, 172: 9-26.

DRIVAS, J. AND JAY, M., 1998. The Fascioliariidae of Réunion. *La Conchiglia*, 289 suppl.: 35-39.

FRAUSSEN, K., 1999. A listing of Recent *Euthria* (Mollusca: Gastropoda: Buccinidae). *Gloria Maris*, 37 (5-6): 77-81.

FUJITA, T., 1929. Report on the dredged shells of Tateyama Bay (2). *Venus*, 1 (3): 88-97, pl. III.

HADORN, R. AND FRAUSSEN, K., 1999. Rediscovery of *Fusinus subangulatus* (von Martens, 1903) and description of a new Somalian *Fusinus* (Gastropoda: Fascioliariidae), including some notes on the taxonomical position of the genus *Siphonofusus* Kuroda and Habe, 1952. *Vita Marina*, 46 (3-4): 111-122.

- HIGO, S., CALLOMON, P., AND GOTO, Y., 1999. *Catalogue and bibliography of the marine shell-bearing Mollusca of Japan*. Elle Scientific Publications, Japan, 749 pp.
- KIRA, T., 1962. *Shells of the Western Pacific in Color (I)*. Hoikusha Publishing CO., Ltd., Osaka, Japan, 224 pp. [for additional printings, see BIELER AND PETIT, 1990].
- KOSUGE, S., 1985. Noteworthy Mollusca from North-western Australia (1) (Preliminary report). *Bulletin of the Institute of Malacology-Tokyo*, 2 (3): 58-59.
- KURODA, T. AND HABA, T., 1971 in Kuroda, Haba and Oyama. [Descriptions of genera and species], *The sea shells of Sagami Bay*. Maruzen, Tokyo. xix + 741 pp. [in Japanese], pls. 1-121, 489 pp. [in English], 51 pp. index, map.
- MALLARD, D., 2001. Survey into Fascioliariidae. *Xenophora*, 95: 8-15.
- MARTENS, E. VON, 1904. Die beschalteten Gastropoden der deutschen Tiefsee-Expedition 1898-1899. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899*, 7 (1), part A: 1-180, pl. 1-9. Jena.
- RICHER DE FORGES, B., 1990. Les campagnes d'exploration de la faune bathyale dans la zone économique de la Nouvelle-Calédonie. Explorations for bathyal fauna in the New Caledonian economic zone. In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 6. *Mémoires du Muséum national d'Histoire naturelle*, (A), 145: 9-54.
- RICHER DE FORGES, B., 1993a. La campagne MUSORSTOM 7 dans la zone économique des îles Wallis et Futuna. Compte rendu et liste des stations. In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 10. *Mémoires du Muséum national d'Histoire naturelle*, 156: 9-25.
- RICHER DE FORGES, B., 1993b. Campagnes d'exploration de la faune bathyale faites depuis mai 1989 dans la zone économique de la Nouvelle-Calédonie. Liste des stations. In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 10. *Mémoires du Muséum national d'Histoire naturelle*, 156: 27-32.
- RICHER DE FORGES, B. AND CHEVILLON, C., 1996. Les campagnes d'échantillonnage du benthos bathyal en Nouvelle-Calédonie, en 1993 et 1994 (BATHUS 1 à 4, SMIB 8 et HALIPRO 1). In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 15. *Mémoires du Muséum national d'Histoire naturelle*, 168: 33-53.
- RICHER DE FORGES, B., FALIEUX, E. AND MENOUE, J. L., 1996. La campagne MUSORSTOM 8 dans l'archipel de Vanuatu. Compte rendu et liste des stations. In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 15. *Mémoires du Muséum national d'Histoire naturelle*, 168: 9-32.
- RICHER DE FORGES, B., NEWELL, P., SCLACHER-HOENLINGER, M., SCHLACHTER, T., NATING, D., CÉSA, F. AND BOUCHET, P., 2000. La campagne MUSORSTOM 10 dans l'archipel des îles Fidji. Compte rendu et liste des stations. In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 21. *Mémoires du Muséum national d'Histoire naturelle*, 184: 9-23.
- RICHER DE FORGES, B., BOUCHET, P., DAYRAT, B., WARÉN, A. AND PHILIPPE, J. S., 2000. La campagne BORDAU 1 sur la ride de Lau (îles Fidji). Compte rendu et liste des stations. In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 21. *Mémoires du Muséum national d'Histoire naturelle*, 184: 25-38.
- ROUX, M., 1994. The CALSUB cruise on the bathyal slopes off New Caledonia. In Crosnier, A. (ed.), *Résultats des Campagnes Musorstom*, volume 12. *Mémoires du Muséum national d'Histoire naturelle*, 161: 9-47.
- SCHEPMAN, M. M., 1911. The Prosobranchia of the Siboga Expedition. *Rachiglossa. Résultats Siboga Expeditie*; Mon 49 (1), part 4: 1-452, pls. 1-30. Leiden.
- SNYDER, M. A., 2000. Nomenclatural emendations in the family Fascioliariidae (Mollusca: Gastropoda). *Proceedings of the Academy of Natural Sciences of Philadelphia*, 150: 173-179.
- SPRINGSTEEN, F. J. AND LOBRERA, F. M., 1986. *Shells of the Philippines*. Carfel Seashell Museum, Manila, 377 pp.
- VERDUIN, A., 1977. On a remarkable dimorphism of the apices in many groups of sympatric, closely related marine gastropods species. *Basteria*, 41: 91-95.
- WILSON, B. R., 1994. *Australian marine Shells*, 2. Odyssey Publ., Kallaroo, Western Australia, 370 pp.